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MANUAL
OF
General Medicinal Technology
INCLUDING
PRESCRIPTION-WRITING

BY

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THIRD EDITION

Conforming to the U. S. Pharmacopœia of 1890

NEW YORK
WILLIAM WOOD & COMPANY

1895

45

WASHINGTON PLACE, NEW YORK,
August 23, 1889.

EFACE TO THE THI EDITION.

his edition the text has been made to
o the U. S. Pharmacopœia of 1890,
ity became standard January 1, 1894.

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GENERAL MEDICINAL TECHNOLOGY.

INTRODUCTION.

THE subject of general medicinal technology naturally divides itself into two parts, namely—first, the technology of *medicines*, and, secondly, the technology of *medicating*. To the former of these divisions belong the topics, severally, concerning medicines, of the *authority* for the same, the technicalities of their *naming* and of their *forms*, the methods of *determining quantities* of them, and the art of their *prescription*; while in the latter are included the two subjects of the different methods of *applying* medicines, and of the regulation of *doses*. These various topics will be treated of in the order named.



PART I.

TECHNOLOGY OF MEDICINES.

CHAPTER I.

THE AUTHORITY FOR MEDICINES.

By the phrase "the authority for medicines," we mean the authority which names and defines drugs, establishes standards of strength and of purity, and issues formulæ for pharmaceutical preparations. Such authority, in the case of nations of imperial government, is commonly vested in the government itself, but in the United States, following the genius of our institutions, the matter is one of voluntary submission by the two professions, respectively, of medicine and of pharmacy to a self-devised arrangement. And that arrangement is as follows: Every ten years representative delegates from certain organ-

uch books generally are, *The Pharmacop*
er arranging for the calling of a succe
Convention then dissolves and its resi
mittee proceeds to its task. In due se
Pharmacopœia appears, and its provision
lly accepted as authoritative by the physic
pharmacists of the country, until the
another decade brings about a new revis
"Pharmacopœia of the United States"
s first established by Convention in 1820,
revision now in force is the seventh t
r, being the outcome of the Conventio
0. This revision will stand until the Con
of 1900 shall take the matter in hand, b
ecial provision its authors are "authorized
ected to publish a supplement at the ex
years, if necessary." The Convention of

incorporated State Medical and Pharmaceutical Associations, and incorporated Colleges of Medicine and Pharmacy, as shall have been in continuous operation for at least five years immediately preceding, to elect a number of delegates, not exceeding three, and the Surgeon-General of the Army, the Surgeon-General of the Navy, and the Surgeon-General of the Marine Hospital Service, to appoint, each, not exceeding three medical officers, to attend a General Convention for the Revision of the Pharmacopœia of the United States, to be held in Washington, D. C., on the first Wednesday of May, 1900."

THE NAMING OF MEDICINES.

THE naming of medicines is one of the functions of the pharmacopœia. In the United States, therefore, we follow the nomenclature established in our own Pharmacopœia. This nomenclature, however, embraces titles in English and in Latin. These, following American habit, are, wherever possible, designed to be as *short* as is consistent with proper identification. For purposes of naming, medicines divide into three categories, viz., *proximate principles*, *crude organic drugs*, and *pharmaceutical preparations*, and in our pharmacopœia the nomenclature of these categories the following points are to be noted : In the case of proximate principles, the nomenclature of the science of chemistry is, in a general way, made the basis of the titles, and in the case of the organic

Sodium becomes now *Sodium Chloride*, and the title *Nitrate of Silver* is changed into *Silver Nitrate*. In the Latin titles the type followed is exemplified by the title *Sodii Chloridum*—a phrase which is a proper rendering of either of the styles of English title for the substance in question, recited above. In a few categories of compounds the action of the Pharmacopœia is peculiar, as follows: 1. In the case of salts of the alkali-metals of different grades, which, in modern chemical parlance, are of *normal* and *acid* composition, respectively, the pharmacopœial nomenclature is that of the chemistry of old, according to which a *normal* salt, as, for instance, normal potassium carbonate, is styled, simply, *Potassium Carbonate*, and the corresponding acid salt *Potassium Bicarbonate*. 2. In the case, again, of metallic compounds which, although containing identical radicals, present the same in different proportion, the modern chemical scheme of turning the name of the metal into an adjective with endings in *-ous* and *-ic*, respectively, is, in some cases (iron and mercury compounds), followed in the English pharmacopœial titles, but never in the Latin. In the Latin titles the metallic component is always expressed by the use of the substantive name of the metal, set in the genitive case, *necessary contradistinction between two grades of*

er. 3. With *compounds having a well-known scientific name*, the same is often adopted in preference to the chemical title. Hence, in place of *potassio-aluminium sulphate*, *ethyl chloromethane*, or *phenol*, we have as their respective official titles for these substances the more familiar names, *Alum*, *Ether*, *Chloroform*, and *Carbolic Acid*.

Concerning, next, the nomenclature of *organic drugs*, the principles followed are succinctly stated in the preface to the Pharmacopœia itself: "1. The official Latin title of a vegetable drug is to be the botanical genus-name. A few titles were excepted from this rule, those of old and well-known drugs, as *Opium*, *ana*, *Frangula*, *Ipecacuanha*, *Pulsatilla*, *Scammonium*, etc. 2. The official Latin title of a mineral drug is to be the preceding rule is

Hyoscyamus, for *Hyoscyamus Leaves*, etc. But if more than *one* part is in use, the part is to be specially mentioned in the title. Examples: *Belladonnæ Folia*; *Belladonnæ Radix*; *Stramonii Folia*; *Stramonii Semen*. 3. The official English titles are to be the scientific, botanical (genus or species) names rather than the vernacular names; except in the case of those drugs where the vernacular names are derived from and [are] still almost identical with the scientific names, or where long custom has sanctioned some other name."

In Latin titles, where two nouns occur, or a noun and an adjective, the Latin idiom of order of sequence of the words is followed. Hence the titles *Leaves of Belladonna* and *Purified Aloes* are rendered, respectively, *Belladonnæ Folia* and *Aloë purificata*.

Lastly, the names of *pharmaceutical preparations* are arbitrary, and will present themselves seriatim when we discuss the forms of such preparations. The only general point to note in this place is that, in latinizing, the Latin idiom just cited is *not* followed as regards the position of the genus-name of the preparation. Thus the title *Tincture of Opium* is not rendered *Opīi Tinctura*, as Latin usage would naturally have it, but *Tinctura Opīi*. Adjectives, however, when occur-



CHAPTER III.

FORMS OF MEDICINES.

THE *forms of medicines* next require consideration, and our study here must be precise, for the products of pharmacy have class-titles and class-peculiarities which must be thoroughly understood by the prescriber. These products are most conveniently grouped for study into those for general and those for special application. Of the former, in the case of solid drugs, the simplest form is the crude drug reduced to *powder*. Pulverization is an obvious prerequisite for the majority of applications of drugs, and where, in a prescription, the powdered condition of an ingredient is a plain necessity, the pharmacist, in compounding, uses the powder without the physician being obliged specifically to order the same. But also certain powders, simple and compound, are among the prescriptions of the Pharmacopœia, constituting thus a kind of preparation under the title PU'LVIS, *Powder*. Limitations in the use of the powder as a form of medicine are, that deliquescent and oily substances

per packages, easily carried about and administered. According to the nature of the substance the powder can be taken dry, or in water, or stirred into molasses, honey, or preserved in a mass of some pulp or substance, such as apple-scrappings, or, more elegantly for older patients, encased in the *capsule* or *pill* sold by druggists for such purpose. The "capsule" is a cylindrical chamber of jujube or similar material, made in two pieces, of which the one fits into the other with a telescopic joint. Capsules are of various sizes, the largest holding three, four, or more grains of vegetable powder, or, if moistened so as to adhere closer, as much even as ten grains. The open and closed capsule, it is needless to say, is swallowed bodily like a pill. "Wafers" are of two forms. In the one two watch-glass

a large, thin, flat wafer proper, which, made limp by moistening, is wrapped about the powder, and the bolus at once swallowed. By the use of these capsules and wafers taste is wholly concealed, and bad-tasting medicines can, by their respective means, be prescribed in powder without objection. In the case of the capsule, furthermore, there is the special advantage that the pharmacist can be ordered to deliver the doses already encapsuled, a convenience both for the matter of carrying and of taking.

In the case of vegetable drugs, which contain, as of course such substances do, all sorts of inert matters, it is a plain desideratum to get the active constituents more or less perfectly isolated. The simplest treatment in this direction, designed for the yielding of a solid product, is to evaporate to a more or less solid consistence a solution containing the desired principles. Such solution may be the natural juices of the plant mechanically expressed, or one artificially obtained by treating the drug with some appropriate solvent. In either case the product derived as described is entitled EXTRA'CTUM, *Extract*.

Extracts vary extremely in consistence. Some are hard enough to undergo pulverization, and such are commonly furnished for use in the condition of powder. A considerable number, on

... examples of the soft
that extracts are hard and what soft
rned by rote, since the pharmacopœial
ture, in the case of extracts, does n
gnizance of the consistence of the prep
special class of extracts is constituted
oducts obtained, by extracting with ethe
ags containing a conjoint volatile oil and
product of such kind is designated, in the
copœia, by the special title OLEORES
oresin. Oleoresins, however, although in
copœial nomenclature a distinct class o
ations, are yet extracts, since, in their m
original solvent is gotten rid of by evapo
n the case of extracts, specifically so-
oresins are bodies of viscid, semifluid c
, and are commonly prescribed, for in
g, in capsule or in mixture.

of strength is frequent, so much so that these particular extracts are distinctly unadvisable in cases where accurate dosage is necessary. Recognizing this fact, the present Pharmacopœia avoids this method of preparation in all cases of extracts, except in the single instance of the inconsequential *extract of taraxacum*.

Of *fluid* pharmaceutical products of general avail there are quite a number, the technical class-names of which are determined partly by the nature of the fluid basis, and partly by other considerations. The broadest division of these categories is into preparations, respectively, where the active ingredient is in *mere mechanical suspension* in a fluid, and, on the other hand, in *true solution*. In the former of these categories, if a *solid* (in powder, of course) is in suspension, the product is MISTU'RA, *Mixture*; but yet this title is not confined to such preparations, but applies, generically, wherever a fluid is a literal *mixture* of diverse forms, whether including a solid in suspension or not. A small number of mixtures are official. If a *fixed oil*, *fat*, or *resin* be in suspension in a watery menstruum, the product is EMU'LSUM, *Emulsion*. *Milk* is a natural example of an emulsion. Oils in emulsion are better borne by the stomach and better assimilated than when swallowed clear, and in such form also the

...the following points must be
red: First, as regards *mixtures* (using the
now in the restricted sense of a solid, in
er, held in suspension in a more or less viscid
e), the main points are these: the *viscosity* is
ally gotten by using mucilage of some kind,
rup or glycerin, letting the viscid constituent
from one-fourth to one-half the bulk of the
re—the heavier and the greater the amount
yder to be suspended, the higher to be the
tage of the viscid addition. Next, the sus-
l matter should not be intrinsically too
—such things as heavy metallic compounds
lomet or the salts of bismuth being best
in some other way than in mixture. Nor
the substance in suspension, even if light,
oo large proportion. Natural vegetable
s should not be prescribed to exceed twenty.

ter substance be selected, not more of the emulsion should be ordered than is likely soon to be consumed, since it does not keep well. In any case, the oil is first to be thoroughly emulsified by rubbing with the undiluted viscid agent, and then, but not till then, the desired dilution with water, or with syrup and water, effected. The proportion of emulsifier to oil ranges from that of one to four to that of one to two. In diluting an emulsion, *saline solutions* and *alcohol*, except in small proportion, must be avoided, else a precipitate will occur. *Volatile oils* are required in emulsion only in small proportion, their presence in a mixture being generally for flavoring purpose only. The emulsion in this case is made by rubbing the oil with any solid that may be intended as an ingredient of the mixture, or, if there be none such, by rubbing with sugar, or even with strong syrup or with glycerin. In the exceptional case where considerable of a volatile oil is required in emulsion, as where a goodly dose of oil of turpentine is desired in such form, an excellent plan is to mix the same with at least an equal volume, or with double the volume, of a bland fixed oil, and then emulsify the mixture of the two substances. Olive oil, sweet-almond oil, or oil of sesamum are fixed oils available for this purpose. It is perfectly possible, however, to emulsify volatile oils

pure resins, by trituration in water, and in the case of gum-resins—natural gums and resins—by the simple addition of water, the gum in the gum-resin dissolves to form a mucilage in which the particles of resin then remain in suspension.

From mixtures and emulsions, where a solid is in suspension in a fluid, undissolved, we pass to forms of preparations where the medicinal substances are in actual solution in some particular fluid. Of the available fluids for such purposes, several, we have a number of technically designated forms of medicines, all of which consist of a number of things in solution. Such preparations are as follows :

The simple title LIQUOR, *Solution*, is applied to all heterogeneous solutions. Some belong to some technically special class.

raniously to prescribe aqueously soluble substances, and, in resorting to such form, two points only need to be remembered. These are, first, that many salts which keep indefinitely in the dry condition, may yet spoil readily in aqueous solution. In such case, therefore, small quantities only of the solution should be made at a time, or else some preservative should be added. Notable examples of salts that undergo change in solution are salts of the *alkaloids*, generally, except the cinchona alkaloids; and, again *generally*, though generally only, salts of any base with the so-called "organic acids," citric, tartaric, acetic, and lactic. Even metallic citrates, etc., fall into the category, and the familiar salts *tartar emetic*, and the *citrates* and *tartrates of iron*, must, therefore, not be counted upon to survive in aqueous solution beyond a very short time. The second point to regard in the prescribing of extemporaneous solutions is the very obvious one of the degree of solubility of the salt to be dissolved. This matter of the solubility of pharmacopœial chemicals in water and alcohol was thoroughly re-tested by the committee who prepared the revision of our Pharmacopœia of 1880, and the results appear in a table in the Pharmacopœia, which is here reproduced.¹

¹ See Appendix.

erb. By the nature of the case such
on must be a *watery* solution of a *volatile*
and, indeed, the distilled waters of form
were mainly waters containing *volatile*
ained by distillation from aromatic her
resent the class "waters" still mainly co
watery solutions of volatile oils, althoug
olutions, with two exceptions (the wa
pectively, of orange flowers and of r
ow made by direct solution of the oil in
ead of by distillation. These aromatic
re feeble in strength, because of the slig
ility of volatile oils in water; they are a
d from agreeably flavored oils, and are i
ather as pleasantly aromatized fluid veh
ntemporaneous solutions or mixtures
edicines proper. Dose—if they can be
ave an exact dose—about a tablespoonf

In the case of the last-named preparation, although the Latin title is *Aqua Hydrogenii Dioxidi*, the English title is *Solution of Hydrogen Dioxide*. With this exception the rule obtains that all simple aqueous solutions of *volatile* things make technically *waters* and not *solutions*.

A distinct small class of preparations is afforded by watery solutions of *gums*—title MUCILA'GO, *Mucilage*. Four such mucilages are official, available, medicinally, as bland demulcents, or, pharmaceutically, as viscid vehicles for "mixtures." They are the mucilages, respectively, of *acacia*, *sassafras pith*, *tragacanth*, and *elm*. Being physiologically inert, these mucilages have no defined dose.

Next in order of simplicity among watery solutions are those that result from the treating of a crude drug with water until its virtues are dissolved out, and the subsequent rejection of the undissolved portions by straining. Such treatment with water may be effected in two distinct ways: in the one, the drug is actually *boiled* in the water, yielding a preparation which then is called DECO'CTUM, *Decoction*, while in the other it is allowed only to *steep*, the water at the time of addition being hot or cold, as the case may be. In the latter case the preparation is entitled INFU'SUM, *Infusion*, and in both these

...specimens, general directions are given for the making of decoctions and infusions, so that the prescriber may order a decoction or infusion of any suitable drug he pleases. The official strength, unless otherwise directed, will be five per cent. of drug substance to a given amount of product. But besides giving such general directions, the Pharmacopœia also establishes by name a few special decoctions and infusions—special either by reason of variation from the usual strength, or because of complex composition. Such special preparations are, severally, *decoction of cetraria*, *compound decoction of sarsaparilla*, *infusion of cinchona*, *of digitalis*, *of willow bark*, and *compound infusion of senna*. Decoctions and infusions, unless gifted with powers of preservation, as is the case to a certain extent with the infusion of cinchona, spoil readily, and

and infusions are very much less used now than formerly, partly because of the above-described drawback of either delay or deceit in the dispensing, but, in main part, for the reason that the refinements of modern pharmacy have outrun the crudity of these bulky and bad-tasting "teas" of old, and have, in almost every instance where a decoction or infusion used to be prescribed, given us some other, and preferable, fluid representative of the drug in question.

The *average dose* of a decoction or infusion will range from two to four tablespoonfuls, but important reductions from this dosage will be required in the case of decoctions or infusions of potent drugs, as, for instance, in the case of the official *infusion of digitalis*, whereof a single dessertspoonful is the beginning dose.

Besides water, *alcohol*, *acetic acid*, and *glycerin* are used as medicinal solvents, because of special properties, affording especial advantages in certain cases, which these fluids severally possess. Of these three solvents alcohol is the most generally applicable, and proves, indeed, of great pharmaceutical value from the fact of its conjoining widely *solvent* with preservative powers. In very many cases, furthermore, compared, as a solvent, with water, alcohol possesses the double advantage of, on the one hand, dissolving more readily,

...ing, many of the other and constituents of the substance. In medicinal vegetable principles which not touch at all are yet quite freely alcohol. Alcoholic solutions are separated into two classes, as follows: the title *TINCTURE*, applies to the analogues of "solutions" among watery preparations, and to the products of soakage of crude solids in the fluid, whereby the alcohol dissolves the virtues. By far the greater number of these are of the latter type, in preparing which a very considerable number of cases, alcohol is more or less diluted with water is used, for pharmaceutical reasons, instead of the undiluted alcohol. Hence tinctures differ materially in strength. Setting aside the two tinctures

whence the name *tincture*, signifying, literally, a something *tinged*. (2) They are *tenuous*, whence the fact that they yield small-sized *drops*, a point to be remembered in the directing of doses of tinctures by such measure. (3) They are *self-preservative*, although, from the volatility of the alcohol of their composition, they will readily, through imperfect corkage of the bottle, suffer the dangerous change of *over-concentration*. (4) As compared with the average decoctions and infusions, they are comparatively *strong*, and hence, in the case of tinctures of powerful drugs, the dose is relatively small, rarely exceeding a teaspoonful, and in very many instances being not more than a few drops. (5) They are, of course, *alcoholic*, and so, in the case of tinctures whose dose is of appreciable bulk, may be objectionable in conditions where alcohol is contra-indicated. (6) They are, as a rule, *less offensive to taste* than the aqueous preparations of the respective drugs, and are, in general, easy of administration. Tinctures are often prescribed as ingredients of composite mixtures, in which case, if mixed with aqueous preparations, regard must be had to possible differences of solvent property between alcohol and water. For if a substance in solution in a tincture be, as is the case with resins, insoluble in water, the same will

the same. Seventy-one tinctures are in the U. S. Pharmacopœia. A special class of tinctures, established, first, by the Pharmacopœia of 1880, is that entitled *Tinctures of Fresh Herbs*. INCTURÆ HERBARUM RECENTIUM. In this class, however, the Pharmacopœia does not give direct preparations of individual drugs, but only a general formula, according to which the pharmacist is to proceed upon receipt of a prescription for the tincture of a fresh herb. The physician is thus given the opportunity of ordering this kind of preparation in the case of any drug he may please, provided only such a drug be obtainable *fresh* in his locality. The Pharmacopœial formula for these preparations is the taking of one part of drug to two of alcohol. This class of tinctures is designed to meet the requirements of cases where the active p

the amount of water contained in their respective juices. Hence, of different lots of the same herb, equal weights may contain very unequal proportions of water, and, consequently, correspondingly unequal amounts of aqueously dissolved active principles.

SPIRITUS, *Spirit*, vernacularly also *essence*, is a title applied to the alcoholic exact analogue of the "water," *i.e.*, to a preparation formerly commonly made by distilling alcohol from a drug holding a volatile principle, but now, as in the case of the "waters," most generally derived by direct solution of the previously isolated principle. The *spirits* of the Pharmacopœia embrace alcoholic solutions of *volatile oils* and of *camphor*, all made by direct solution; of certain *ethereal* bodies—ether, chloroform, nitrous ether, etc.; of *ammonia*, of *glonoin* (nitroglycerin), of *phosphorus*, and of the two distilled liquors, *brandy* and *whisky*. Of these several groups, the spirits of the aromatic oils form a distinct class, naturally comparable with the "waters" prepared from the same substances. In such comparison there is an agreement—both sets of solutions are of peculiarly aromatic or fragrant oils; and a difference, the "waters" being weak, while the spirits are strong, for the reason that alcohol is a free instead of sparing solvent of volatile oils. The

erica, *juniper* (simple and compound), *anemone*, *peppermint*, *spear-mint*, *myrcia* (*myrica*), and *nutmeg*. Spirits, like tinctures, are valuable because of their concentration and preserving qualities, and, medicinally, are of advantage or of disadvantage, according to circumstances, from the alcohol of their composition.

VI'NUM. *Wine*, is the title where wine is used instead of diluted alcohol as a solvent. 'Tincture' is

used in such cases is a natural weak "white wine", which, with the addition of a small amount of alcohol or of tincture of sweet orange, is then applied in the same way as alcohol. 'Tincture', viz., to dissolve chemicals, or to preserve the virtues of vegetable drugs. Medications made thus are thus really a variety of tincture, but not a poor variety at that, being less concentrated and more liable to spoil than tinctures.

well, though not so well as alcoholic ones. The acid, diluted, is used in two cases to extract the virtues of vegetable drugs, but in each case we have other preparations equal, at least, in value. The title of the product is ACE'TUM, *Vinegar*, and the strength a uniform one—virtues of ten per cent. of crude drug in a given quantity of preparation.

Glycerin is a unique menstruum, combining, like alcohol, extensive solvent powers with keeping properties, but, unlike that fluid, being, physically, viscid and non-volatile, and, physiologically, of mild taste and bland quality. Six glycerin-solutions are official, viz., of *carbolic acid*, *tannic acid*, *starch*, *boroglycerin*, *hydrastis*, and *yolk of egg*. The title of a glycerin-solution is GLYCERI'TUM, *Glycerite*.

Lastly among styles of fluid preparations for varied use comes the invaluable EXTRA'CTUM FLU'IDUM, *Fluid Extract*, which is an alcoholic extract concentrated by evaporation, and, unless self-preserving, fortified against change by some appropriate means, such as by the addition of glycerin. A unique peculiarity of fluid extracts is the strength of the preparation, which is uniform, and so ordered that the fluid extract shall exactly represent in a given *measure* the virtues of the corresponding weight of crude drug from

tract is the medicinal equivalent of
drug. In our own more familiar w
and apothecaries' weight the corres
not exact, simply because a fluidrach
exact measure of a drachm-weight of
it is yet so near that, with the e
latitude of dosage, it is perfectly le
prescribing, to reckon that a *minim*
tract will equal a *grain* of drug ; a fl
drachm, and a fluidounce an ounce.
tracts are, then, fluid preparations as
be from inert or obnoxious constitue
crude drug ; keeping well, concentrat
strength, bearing a uniform and simp
to the strength of the original drug
Because of these obvious advantages e
of the Pharmacopœia has added lar

tration of the preparation—with powerful drugs a single drop often being full allowance.

Passing now to the styles or literal *forms* of medicines which are designed for special applications, we find forms especially devised for giving by the *mouth*, others for use by the *rectum*, and others for application to the *skin*. For giving by the mouth we have, first, a form of powder, devised for the purpose of securing extreme fineness of pulverization and of yielding a powder of convenient bulk of dose in cases where the simple powder of the drug would prove inconveniently small. For this combination of purposes the scheme is to triturate a medicament thoroughly with a proper quantity of *sugar of milk*, a substance which combines the qualities of hardness of its particles, solubility in water, and agreeability of taste. For such a *dilute* powder the Pharmacopœia authorizes, under the title TRITURATIO, *Trituration*, the rubbing of one part of a powdered drug with nine of sugar of milk. The direction here is simply a general one, so that the prescriber has the privilege of ordering any powder he pleases to be made into a “trituration.” The trituration is a convenient form for the giving of powdered drugs whose dose is small, and, because of the fineness of pulverization obtained, is the form of solid medicine that most

to taste unduly bad, and they are, as a rule, administered dry, upon the tongue.

In the reverse set of cases, where, instead of a concentrated powder is desired, we have the indication met, so far as they go, by the *lozenges* which are capable of pulverization.

In the case of children or of squeamish adults it is always desirable to conceal offensive taste in medicine. One way of so doing, with powders, is to incorporate the material in a sugary mass, thus combining the agreeable qualities of soft confectionery—a method which meets the indication, in a measure, but does so at the disadvantage of throwing upon an invalid stomach those obnoxious matters, *sugars*, in considerable quantity. Here, we find in the Pharmacopœia two preparations of this character: technical name *Confectio*

cussed, finds place in the Pharmacopœia under title PI'LULÆ, *Pills*, and MA'SSA, *Mass*—that is, pill-material before subdivision. The terms *granule* and *parvule*, often applied to very small pills, are vernacular only. Here is, in the literal sense of the word, a *form* of medicine availed of by the physician for extemporaneous prescription, as well as by the Pharmacopœia for a set formulary of preparations. The pill-form presents many peculiar features for consideration, some of advantage and some the reverse. Of advantage are permanence, portability, exactitude and convenience of dosage, and concealment of bad taste; while of disadvantage are comparative slowness and uncertainty of absorption of the contained medicament, difficulty or impossibility of administration to many persons, including obviously the entire class of *little* children, who constitute so very large a proportion of our patients. Convenient, therefore, as pills are, they must not be prescribed with stupid indiscrimination. Almost any solid medicine not deliquescent, in powder or as extract, and also many fluids, provided, of course, the dose be small, may be ordered to be dispensed in pill-form. Pills when freshly *made* are dusted with some dry powder *to prevent them from cohering*, or are coated *with some material with the view of concealing* "

a box with gold or silver-leaf. By this
pills become loosely coated with bit
ten foil—a covering which fairly
ceals the taste and yet readily gives
swallowing, so as to interpose no ob
solution of the pill in the stomach.
stances so largely used for coating
gums, gelatin—require special manip
even apparatus for their application
practically available only for the
of a considerable number of pills.
a dozen or so extemporaneously pre
can, therefore, hardly, with profit to
ser, be coated with any of these mate
coatings have furthermore the fea
time required for their dissolution
ach is just so much time lost for the
the pill, and if such time be consid

are desirable, coated pills (coated otherwise than by metallic foil) had better not be allowed. Besides coatings for the concealment of taste, some pills, because of the nature of their ingredients, require an air-tight casing, as, for instance, pills containing phosphorus or ferrous iodide, substances that easily oxidize on exposure. Balsam of tolu is used for such coating, and the pills thus prepared are open to the same possible objection as just urged against other coated pills.

As regards the administration of pills, the majority of persons old enough to take a pill at all can readily swallow the little sphere if put far back upon the tongue and helped along by a gulp of water. But if there be reflex objection on the part of the surprised pharynx, encase the pill in some slippery mass—chewed bread-pulp, apple-scrappings, or a bit of preserve; or—a method found to succeed when all others fail—take a dark-skinned grape, in which the pulp slips easily from the skin, dig out the seeds, put the pill in their place, and then give the grape to be eaten in the way so commonly done, *i.e.*, by popping the pulp into the mouth and swallowing at once without chewing. But in spite of every device, some persons, even adults, can never swallow a pill—the mere knowledge of the pill's

instances a pill-mass only is ordered, leaving it to the prescriber to direct the weight of individual pills, but in all other cases the Pharmacopœia establishes the weight of the mass, as well as the composition of the mass. A pill-mass is entitled MA'SSA, *Mass*; pills, PI'LULÆ, *Pills*. The three pharmaceutical "masses" are those, severally, of *copperous carbonate*, and *mercury* ("blue mass").

The pill is one of the forms very commonly selected for the extemporaneous prescription of appropriate drugs. In so prescribing, the physician must be had to the points already mentioned concerning what medicines and *what patients* properly enter into pill-relation. But the subject presents itself the subject of *excipients*. The very condition of the pill necessitates

qualities of the basis. Considerable knowledge of pharmacy is thus involved in the proper fitting of excipient to basis, and because of this, and because, nowadays, the physician is not expected to be also a pharmacist, it is the practice with many, in prescribing extemporaneous pills, simply to order that so much of a given medicine shall be made into so many pills, leaving it entirely to the compounder to take what and how much excipient pharmacy knows to be best for the case. But since many physicians, on the other hand, prefer, in prescribing pills, themselves to direct the excipient, it is proper to point out here the general principles governing the selection. *Sticky vegetable extracts* require no excipient, and, furthermore, those of feeble medicinal power make, themselves, capital excipients for *heavy powders*; for example, extract of gentian as the excipient for reduced iron. If a little too firm, a few drops of water will effect the necessary softening. *Soft gum-resins* need no excipient, or at most a few drops of alcohol to reduce hardness. *Semifluid or fluid* substances require some indifferent dry powder, such as powdered gums or starches. Bread-crumbs, wheat starch, or gum-arabic are the substances most commonly used for the purpose. *Powders*, if *heavy*, such as metallic compounds in powder, may be mixed with a soft

fluid, such as syrup, honey, or glycerine, the latter substance, because peculiarly adapted to the purpose, is specially advantageous if it be desired that the pills be kept soft for some time. On the other hand, *mucilage* is objectionable as an excipient, because pills made by the use of this material speedily become hard—too hard to obtain solution in the stomach. *Resinoid bodies* do well by admixture with some fluid. In case, in prescribing the excipient it is desired to order the *selection* only, leaving the *amount* to the compounder. A special form of pill, possible to make with appropriate material, is the so-called *compressed* pill—a pill which contains little or no excipient, but to which the action of the medicament, in dry powder, is such that the particles are made to cohere, so as to retain their form by the application of powerful d

of the pill. In general, pills should be of small size only; and hence, as a rule, there should not be ordered, to constitute a single pill of light bodies, such as vegetable powders, more than *five grains* (thirty centigrammes), or, of heavy substances, in excess of *six or seven grains* (from forty to forty-five centigrammes). And better is it, indeed, not to exceed the one-half of these weights, respectively.

TROCHI'SCUS, *Troche*, is the technical name of the well-known *lozenge*, applied as a form of medicine. Troches are designed to be held in the mouth and sucked until dissolved, and are resorted to, mainly, as affording a convenient way of continuously medicating the oral or pharyngeal cavity in surface affections of those parts. Under the circumstances slowness of solution—contrary to what obtains in the case of pills—is here an advantage, and hence we find *tragacanth* as the gummy basis of a majority of the official troches. Troches are pleasant to take, and, besides their more natural purpose, as above, are often used as the form for medicines aimed to relieve cough—many of the official and numberless of the proprietary troches being compounded for this special application.

Partaking of certain of the properties of the pill on the one hand, and of the troche on the other, is

is a thick disc of small diameter of the average pill—and composed of some soluble medicine made into a solid form by admixture with some soluble excipient. A soluble tablet is constituted of soluble ingredients for the reason that the special purpose of the tablet is to afford a means of having repeatedly and accurately determined doses of a medicine administered *by solution*. The majority of tablets of the market dissolve readily in cold or warm water, and the convenience of their use is obvious. Besides their legitimate use of thus serving as a means for the external preparation of a dose of a medicine in solution, tablets may also be used as substitutes for pills, since the little discs are readily swallowed whole by any one who can swallow a pill.

syrups are official, the group embracing syrupy solutions of salts and other inorganic substances, as well as of vegetable drugs—in certain of the former kind the sugar being of more importance as a preservative than as a flavoring agent. These same syrups of inorganic matters are too incongruous to present any general class-characteristics, but the syrups derived from vegetable drugs form a fairly distinct group. Such syrups are variously made by the addition of sugar or of syrup to expressed juices, solutions, “waters,” infusions, decoctions, “vinegars,” tinctures, and fluid extracts. They are of course sweetish to taste, and so are pleasanter than the average fluid medicines, but, medicinally, they rate comparatively low in strength, and are not to be resorted to where concentration of dosage is desired. Rarely is the dose less than a teaspoonful¹ and often it is a tablespoonful or more. A number of official syrups, furthermore, have no, or practically no, medicinal power whatever, and are offered simply as agreeably flavored matters to constitute part of the fluid vehicle in extemporaneous prescriptions. When so used, these syrups should, as a rule, not form more than one-half the volume of the mixture, else the potion will be too sweet unless diluted at

¹ Notable exception, compound syrup of squill.

avoring agents are "syrup," and the
generally, of *citric acid*, *almond*, *orange*
flowers, *wild cherry*, *rose*, *raspberry*,
ginger. The syrups, respectively, of *al-*
thaea are mucilaginous as well as syrupy.

Concerning all syrups a final point ne-
cessary to be made is that the preparations are more or less
subject to change. Often in the domestic medicine
cabinet a long-kept bottle of syrup, as of ipecac
syrup, is found with the cork blown out and the con-
tents turbid and frothy. These conditions are the re-
sults of fermentation, one of the commonest
modes of decomposition to which syrups are
subject. Hence in prescribing syrups, or in
the preparation of one to which a syrup largely enters, the
physician should consider no more of the preparation than is
usually used for the case in hand.

toothsome medicines, has been to offer a fluid composition containing a little of some drug-principle and a good deal, severally, of alcohol, sugar, and aromatic flavoring. Such a preparation the manufacturers have entitled ELIXIR, *Elixir*. Recognizing the hard fact of the popularity of these elixirs, the Pharmacopœia has thought it no more than fair to offer to the legitimate prescriber a ready means of competing with the wholesale manufacturer in this field. We find, therefore, official a so-called *Aromatic Elixir*—simply dilute alcohol, sweetened and flavored with the oils, respectively, of orange peel, lemon, coriander, and anise—which elixir may be used as a vehicle for the making of medicated elixirs, either by dissolving substances directly therein, or by charging it with the proper quantity of a tincture or fluid extract. But in prescribing this elixir-basis, it must be borne in mind that the same is nearly *twenty-five per cent. alcohol*—is stronger, that is, in alcohol, than the strongest sherry wine. Medicate it weakly, then, as is the way with elixirs; order it in tablespoonful doses, as is the necessity in the case of weak mixtures; let it be taken regularly for a month or two, as is the rule with “tonic” medicines, and then be not surprised if the whiskey-bottle succeeds the elixir-vial on the shelf of the patient’s private closet. There is also

urethra, we have the simple device of
incorporating the medicament with a material
liquefying readily at the temperature
is yet firm enough to admit of being put
in form of a solid plug, into one of
All such medicated plugs are, generic
suppositories, and under the simple
POSITO'RIA, *Suppositories*, the Ph.
establishes a general method for the
suppositories of any drug which the
may prescribe, and for any one of the
excipients just mentioned. The excipient
is cacao butter ("oil of theobroma")
that perfectly meets the requirements
according to the Pharmacopœia, "un-
specified, Suppositories should have
weights and shapes, corresponding

Rectal Suppositories of

of designated drug and make it into a certain number of suppositories of specified kind. A single specially medicated kind of suppository is official, namely, *Suppositories of Glycerin*. Rectal suppositories are the kind most commonly used, and, concerning their application, the only points are that the medication will be more thorough the cleaner the cavity that receives it, and that, in insertion, the plug must be pushed up beyond the sphincter.

To medicate the *skin*—or the system at large through the avenue of the skin—we have a number of special pharmaceutical forms. It is here often most suitable that the medicine be incorporated with a *fatty* substance, for the reason that greasy dressings protect from the air, prevent drying, and, more readily than water-moist matters, permeate cracks, crannies, or even the unbroken tissue of the skin. Medicated fatty mixtures give us three classes of preparations, as follows :

UNGUE'NTUM, *Ointment*, is the title when the substance is of soft, lard-like consistence, suitable, when so needed, for inunction. The most commonly-used bases for ointments are, severally, *lard*, or lard with a small admixture of wax slightly to increase its firmness, and the well-known *singular* substance *vaseline*, so-called.

leates in oleic acid. Such a preparation is usually entitled OLEATUM, *Oleate* is enough in the Latin, but, in the English, to breed confusion, because thus the technical name of a specific solution of a salt is identical with the simple chemical name of the salt itself. These so-called "oleates" were devised because of the peculiar properties of oleic acid, which it possesses, and with which its salts, of *permeating tissue* with great readiness. "Oleates," therefore, are more valuable than ointments for the medication of such subcutaneous tissues as are unusually dense. Theoretically, these preparations surpass ointments for medicating the *blood*, and so the same may be said for the method of inunction. The

These preparations, therefore, should be but lightly applied, and, in the case of sensitive skins, should be dosed with one per cent. of morphine—the alkaloid, not any salt of the same—before application. Such charge of morphine will dissolve by combining with some of the free oleic acid of the preparation to the formation of a soluble oleate of the alkaloid.

The Pharmacopœia recognizes three “oleates,” viz., those, respectively, of *mercury*, of *zinc*, and of *veratrine*, whereof the first is of twenty, the second of five, and the third of two per cent. strength of dissolved base. Other “oleates,” however, are offered by manufacturing pharmacists. According to their strength and to the nature of the base in an “oleate,” these preparations vary in consistence from that of a thin oil to that of a soft fat, such as lard.

Besides “oleates” such as the foregoing, where the preparation consists of an oleate proper in solution in an excess of oleic acid, certain oleates—using the word now in its proper chemical sense—are articles of manufacture and are of use for local medication of the skin. The oleate of *lead* is an example in point. These oleates, contradistinguished from the pharmacopœial preparations styled by the name, are dry, pulverulent bodies, of a *smooth*, soapy feel.

quantities found pre-eminent in
material that results from the boiling
litharge, olive oil, and water.
known as "lead plaster," is thus
for these preparations, other bases
admixtures of resins, gums, wax
Plasters are hard at ordinary temperature
require softening by heat for spreading
use the material is spread in a thin
sheepskin or other leather, or upon
muslin cloth, and, for application,
not require to be somewhat softened by
heat. When once upon the skin, plaster
tight, resist water, except in the case
plaster," and, for removal,

time air is excluded from the part and a gentle local irritation maintained. Some plasters, indeed, such as *adhesive* and *court* plasters, are for no other purpose than to afford protection and coaptation of parts.

Plasters are prescribed by dimension, in inches, and not by weight, and are dispensed by the pharmacist ready spread upon proper backing.

LINIMENTUM, *Liniment*, is a name applied generically to any more or less distinctly *fluid* preparation (except "*oleates*") intended for rubbing upon the skin. The pharmacopœial liniments are so very incongruous as to present no class-features for present discussion.

Lastly among pharmacopœial preparations comes CHARTA, *Paper*, meaning, naturally, a medicated paper. Two such "*papers*" are official. Of these, one—namely, the paper of *mustard*—is intended for local application to the skin, and consists of paper coated on one surface with a preparation of the drug. The other, paper of *nitrate of potassium*, consists of a bibulous paper impregnated throughout its texture with nitre, and is intended to be burnt for the sake of evolving medicated fumes for inhalation.

Finally, to close the subject of forms of medicines, we may note here the following technical terms, which, although not occurring in pharma-

mented on; *catapla'sma*, "poultice";
"little paper," meaning, in prescription,
the separate paper package into which
of a powder is to be put up; *colly'*
drops"; *discus*, "disc," generally
of gelatin, medicated, for application to
eye or for solution for hypodermat
e'nema, "enema," "clyster," a rect
gargari'sma, "gargle": *hau'stus*, "a
considerable potion to be swallowed";
inje'ctio, "injection"; *lo'tio*, "lotion";
pedilu'vium, a foot-bath; *su'ccus*,
formerly official, meaning the expressed
of a vegetable drug preserved by the addition
of a little alcohol.

CHAPTER IV.

THE DETERMINING OF QUANTITIES OF MEDICINES.

THE subject of the *determining of quantities* of medicines concerns the physician, first, in the matter of the *compounding of extemporaneous prescriptions*, and, secondly, in that of the *dispensing of doses*. For one or the other of these purposes both of the two several methods, *weighing* and *measuring*, are employed, so that the technology of both of these methods requires consideration.

Of the determination of quantities of medicines by weight.—As a process, weighing has the advantage over measuring of being intrinsically capable of greater accuracy of achievement, but yet is subject to the disadvantage that it requires special apparatus and skill for its accomplishment. Hence, since patients cannot be expected to own and operate balances, weighing is entirely ruled out from application to the important purpose of the *domestic dispensing of doses* in the case of medicines ordered in bulk, whether fluid or

the pharmacist in the compounding
tions. For this purpose the greater
the method commends it ; and, furt
one who, like the pharmacist, ow
adept at the balance, determinations
are quicker and more convenient of
ment than by measuring. This fact i
the case of dealings with solids, but
case of fluid medicines the balance
measuring-glass in convenience, wh
passing it in accuracy. For it is on
to counterpoise, upon a pan of t
the bottle in which a prescribed mix
dispensed (an operation done in a
by an experienced hand), when,
secutive addition of the proper
after another of the fluid constituen

prefer to compound by weight not only in the case of solids, but also in that of fluids, and such, therefore, of course, desire that the physician prescribe his quantities in terms of weight. Now, this the prescriber is willing enough to do in the case of *solid* drugs, since *doses*, in the case of solid medicines, are to be dispensed, and are, therefore, learned, by weight. But in the matter of *fluid* constituents of a prescription there arises an issue between prescriber and compounder, for the following reason : In the greater number of instances where a fluid medicine is prescribed, the final product is to be a bottle of fluid, for internal giving, by doses to be doled out at the bedside. Now, such doses, it hardly needs to be said, are to be *measured* from such bottleful, and not *weighed*. In the prescribing, therefore, the physician has in mind simply an aggregate of *volumes*, and must apportion his ingredients by measure of volumes only. In such case, then, if the prescription is to be filled by means of the balance instead of the "graduate," it comes to the prescriber's ordering *volumes* by *weight* ; which means that, having thought out his volumes, he is to find out what the same will weigh, and then write for the quantities by the figures thus calculated. Now, since no two fluids weigh just the *same*, *measure for measure*, this translation from

ails tedious computations for every
of a quantity. And such seeming
tedium it is that constitutes the theo-
tion of the prescriber to the plan in q

Practically, therefore, in the ma-
scriptions, while weighing is univers
in dealing with solids, it is otherw
country, in the case of fluids. Yet, a
are now daily learning, by foregoing
of accuracy the difficulty from dive
cific gravities shrinks to trifling prop
then, *if only there be at hand a perfect
system of weights and measures*, it is
set down quantities of volume in ter
as in terms of measure. Now, suc
obtains in the so-called *metric syste*
France, but now standard also in t

the country, both native as well as foreign, so that the practical procedure of prescribing volumes by weight demands consideration.

Now, the sole difficulty of the procedure arises, as we have seen, from the diversity of specific gravity among fluids, and presents itself thus : The correlation of metric weights and measures of capacity is through the medium *water*; the weight of a standard volume of this fluid (one cubic centimeter) being taken as the basis for the system of weights (one gramme). With *water*, therefore, there is absolutely no trouble, the same figure expressing quantity in terms of weight and of volume, both. This being so, let us look at our fluid medicines from the point of view of their *specific gravities as compared with that of water*. A very large number of such medicines are themselves of aqueous basis, or, from the proportion of their ingredients, show a gravity but little different from that of water—a difference so slight that the error introduced by disregarding it altogether is within the *error of dosage* (*i.e.*, the amount more or less than a given quantity whose physiological effect is inappreciable). Hence the practice—and a perfectly legitimate one—to ignore altogether the individuality of gravity among these medicines, and to treat them as if they weighed the same as water. And so, behold !

... ~~... ..~~ at the
of this medicine when description is
entirely unimportant to value. There
being, a considerable number of fine
in the box of the medicine, which when
properly mixed is considerably more than
that, in mixing weight with a view to
value, the quantity must be taken into
these things, however, divide for the
medications, into three categories. First
which while possessing a striking index
of specific gravity, are from the nature
of their medicinal, ~~... ..~~ ~~... ..~~ the use
of ~~... ..~~ for internal use, and
a prescription, do not need to be thought

please—its volume is of no practical moment; and chloroform, though half as heavy again as water, is yet rarely so prescribed in combination as to require that cognizance be taken of the volume of a given weight.

The second category embraces medicines which, though combined in prescriptions, yet necessarily occur therein in such small proportions, as compared with the bulk of the bottleful, that a trifling error of quantity, when divided, as it comes to be, by the number of doses, falls again within the "error of dosage," and may therefore be disregarded. Into such category we may put, as one group, the *volatile oils*, the *spirits*, *tinctures made from alcohol* as distinguished from those where diluted alcohol is employed, and certain of the *fluid extracts*. Measure for measure, these fluids are one-tenth lighter in weight than water, and hence to get one cubic centimeter in volume we should, in accuracy, write for ninety centigrammes only, in weight. On the other hand, a few *fluid extracts* are appreciably heavier than water, but all the classes of preparations named are prescribed, in combination, in such small relative proportion that the several corrections for specific gravity may safely be, as they commonly are, quietly omitted in practice.

There is left, then, of the bone of contention

bination they will occupy a goodly or greater part of the bottleful. With this then, there is no escape ; we *must* allow specific gravity when ordering volumes in composite prescriptions. But behold is but the trifling one here displayed corrections, as the table shows, are the things possible :

TABLE OF CORRECTIONS FOR SPECIFIC
(As practically required for application
prescribing of volumes by weight, in
prescriptions.)

To get 1 C.c. of—	Order, 1
Oils.....	0.90
Glycerin	1.25
Syrups and honey	1.33

As thus applied, then, by the help of the peculiarities of the metric system the prescribing of fluids by weight is perfectly easy. The really objectionable feature of the system is that it introduces into prescriptions calculated upon a basis of volume an error commensurate with the specific-gravity value disregarded. But apart from the question whether this error is of practical importance or not, it is probably compensated for by the greater accuracy by which weights can be determined—the exactness of the compounding atoning, so to speak, for the inexactness of the prescribing.

Next we pass to the consideration of the different *scales of weight* used in dealings with medicines between physician and pharmacist. Three such only are likely to come under our cognizance. They are, first, the *apothecaries' weight*, consisting of the grain, the ounce, and the pound of troy weight, with the intercalation of two special denominations between the grain and the ounce; secondly, a *mixed weight* made standard by the British Pharmacopœia, consisting of the troy grain and the avoirdupois ounce and pound; and, thirdly, the weights of the *metric* system. Of these weights the apothecaries' is the one commonly used with us; the British pharmacopœial weight is peculiar to Britain, and the metric

of science, and is daily making service
also in the prescribing of medicines.

Following is an exhibit of apothecari
the table also giving the Latin nan
denominations and the symbols there
prescription :

TABLE OF APOTHECARIES' WEI

Grain (<i>Gra'num</i>).	Sbruple (<i>Scru'pu- lus</i>).	Drachm (<i>Dra'chma</i>)	Ounce (<i>U'ncia</i>)
Gr.	℥	ʒ	℥
20	= 1		
60	3	= 1	
480	24	8	=
5,760	288	96	1

the grain the dr

these same relations, which, despite the intrinsic advantages of the numbers 60 and 480, make the use of the scale, as compared with a decimal one, slow and cumbrous. There is also wanting any exact correlation between these weights and any standard measures of capacity.

The peculiar weight of the British Pharmacopœia is thus shown in tabular form :

TABLE OF BRITISH PHARMACOPŒIAL WEIGHT.

(Troy grain, avoirdupois ounce and pound.)

Grain (<i>Gra'num</i>).	Ounce (<i>U'ncia</i>).	Pound (<i>Li'bra</i>).
Gr.	oz.	lb.
437.5	=1	
7,000	16	=1

This system has the disadvantage that the ounce is an odd number of grains, but it possesses the two advantages, to offset, first, that it is the same system by which drugs are bought and sold commercially ; and, secondly, that it is, partially at least, correlated to a scale of measures of capacity, the ounce being the exact weight of a fluid-ounce (imperial measure) of water, and the pound weighing *one-tenth* of an imperial gallon. As

namesakes, the ounce being less and the
more, as shown by the column of grains
in the table. In prescribing in-
ough the use of the apothecaries' (tre-
nd of the pound is discouraged by the
Pharmacopœia, the use of the *scruple* as
drachm is sanctioned by the same au-
thority. Hence the symbol "3" in British writing
denotes the apothecaries' drachm of sixty grains
and the *avoirdupois* drachm of twenty-seven
grains and a fraction, the *avoirdupois* drachm is
not recognized in the British Pharmacopœia.

The *metric* system has the enormous ad-
vantage that the denomination-ratios are identi-
cally decimal, thus conforming, as in the case of the
American currency, to decimal notation and
reducing calculations to the extreme of

TABLE OF "METRIC" OR FRENCH DECIMAL WEIGHTS.
(More or less in use, universally, in the prescribing of medicines.)

Milli-gramme	Centi-gramme.	Deci-gramme.	Gramme (<i>Gram- ma'rium</i>).	Deca-gramme.	Hecto-gramme.	Kilo-gramme	Myria-gramme
Gm. — 0.001	Gm. — 0.01	Gm. — 0.10	Gm. — 1.00	Gm. — 10.00	Gm. — 100.00	Gm. — 1,000.00	Gm. — 10,000.000
10	— 1						
100	10	— 1					
1,000	100	10	— 1				
10,000	1,000	100	10	— 1			
100,000	10,000	1,000	100	10	— 1		
1,000,000	100,000	10,000	1,000	100	10	— 1	
10,000,000	1,000,000	100,000	10,000	1,000	100	10	— 1

An independent peculiarity and this system of weights is that it is related to an analogous system of capacity, the weight of a standard centimeter³ of *distilled water*, at its of greatest density, being the *gram* of weight. This correlation helps in that translation from estimate by volume to by weight, which is involved, as also in the plan of prescribing fluids by weight.

Since the metric and apothecaries both in use in American prescriptions know the relative values of the respective units of the two systems. *Example*—
is 15.43994074

ents of intermediate values can easily enough be calculated mentally. The *approximate* metric equivalents are accurate enough for prescription purposes, the exact values being added for information and not for use :

TABLE OF EQUIVALENTS.

Apothecaries' and Metric Weights.

APOTHECARIES'.		METRIC.	
		(Approximate.)	(Exact.)
Gr.	$\frac{1}{64} =$	0.001 Gm. [	0.00101 Gm.]
Gr.	$\frac{1}{32} =$	0.002 Gm. [	0.00202 Gm.]
Gr.	$\frac{1}{16} =$	0.004 Gm. [	0.00405 Gm.]
Gr.	$\frac{1}{12} =$	0.005 Gm. [	0.00540 Gm.]
Gr.	1 =	0.06 Gm. [	0.06480 Gm.]
Gr.	10 =	0.65 Gm. [	0.64799 Gm.]
Gr.	15 =	1.00 Gm. [	0.97198 Gm.]
℥	1 =	1.30 Gm. [	1.296 Gm.]
℥	1 =	4.00 Gm. [	3.888 Gm.]
℥	1 =	30.00 Gm. [	31.103 Gm.]
℥	2 =	62.00 Gm. [	62.207 Gm.]
℥	4 =	125.00 Gm. [	124.414 Gm.]
℥	8 =	250.00 Gm. [	248.823 Gm.]
℥	16 =	500.00 Gm. [	497.658 Gm.]

case of fluid medicines, p

measure, and also, quite commonly, division into parts of gross amounts of cines, such as pill-masses and powder. In the making of pills, a weighed quantity of pill-mass is rolled out into a cylinder of a certain length, and this cylinder is then cut up into a number of equal subdivisions by a machine. In the case of powders, the gross amount is spread out into an elongated pile, which is then subdivided, by mensuration, into a certain number of parts. In the sick-room, the art of measuring has an important application in the determining of doses of fluid medicines, for which, as already seen, the use of weighing is practically inapplicable.

Mensuration, although, as stated, is less accurate than weighing of yielding

vessel be partially filled, but convex if the same be brimful. Aligned, therefore, by a mark or brim, the volume of a fluid is not exactly in fact what it seems to be. And evidently the error will be proportioned to the relation between area of surface and volume. If the area of surface is small compared to the volume measured, the error will be small; if large, large. Accuracy in the measuring of volumes, therefore, depends vitally on the shape of the measuring vessel, the extreme of accuracy obtaining with the capillary-necked specific-gravity bottle, and of inaccuracy, let it be noted, with the shallow and flaring *spoon*. When anything like reasonable precision is required, therefore, tall and narrow instead of short and squat measuring vessels should be employed. For the measuring of medicines, tall, narrow graduates should be used for considerable volumes, and graduated pipettes for small. Even in the household, for the bedside measuring of doses (if the attendant be intelligent enough to use them), properly shaped graduates, or, for measures less than a fluidrachm (four cubic centimeters), graduated pipettes, should, in all cases requiring reasonable precision, be used in place of the faithless spoon.

The standard measures of capacity applied to *dealings with medicines* are, in the United States,

capacities of the *drop*, the *spoon* in its fullness, the *wine-glass*, and the *cup*, are also employed.

Apothecaries' measure is as follows :

TABLE OF APOTHECARIES' OR WINE MEASURES
Used in U. S. in the prescribing of medicine.

Minim (<i>Mini- mum</i>).	Fluidrachm (<i>Flui- dra'chma</i>).	Fluidounce (<i>Fluid- u'ncia</i>).	Pint (<i>Oc- ta'rius</i>).	Gallon (<i>Co- quiti</i>).
℥	℥ 3	℥ 3	O.	
60	=1			
480	8	=1		
1280	128	16	=1	
		128	8	

between the denominations *minim*, *fluidrachm*, and *fluidounce* are identical with those between the weight-denominations, *grain*, *drachm*, and *ounce*. The important differences between the two tables are, first, that in the table of measures there is no analogue of the weight-denomination, *scruple*; secondly, that the pint—the analogue among measures of the *pound* among weights—is of the value of sixteen of the next lower denomination, instead of twelve as is the case with the pound; and, thirdly, that there is, among measures, a denomination, the *gallon*, which has no analogue among weights. So far, however, as concerns the three lower denominations, which are those most used by the prescriber, the table of measures presents the convenient feature of an identity of inter-ratios with those obtaining between the analogous denominations in the scale of apothecaries' weight.

The various analogies in names and ratios noted above between the denominations of weight and measure, respectively, of the apothecaries' system, instinctively suggest some exact *correlation in fact* between those weights and measures, respectively, that are of similar title. But, unhappily, such desirable correlation does not exist. There is, however, an *approximate* correlation between apothecaries' weights and measures, through the

RES.

ough, in the
 purposes of the
 filled water, at
 455.7 grains—a
 t what, for the
 s, it is safe to
 as weighing an
 commonly safe to
 dim as weighing,
 ain.

a of measure in use
 ollowing table :

MEASURE.

ibing of medicines

ce	Pint (Oc- ta'rius).	Gallo (Co't gius
	O.	C.
1		
20	=1	
30	8	

s noted that
 same as in

measure, and that, with the exception of the number of fluidounces to the pint, the denomination-relations are also identical. The actual values, however, even of the denominations of the same inter-ratio, differ slightly in the two systems, the *minim*, *fluidrachm*, and *fluidounce* of the imperial measure being but ninety-six per cent. of the respective capacities of the same denominations in apothecaries' measure. The imperial pint, however, being composed of a greater number of fluidounces than the apothecaries', is larger than the latter measure, and necessarily, therefore, the imperial gallon exceeds the gallon of the apothecaries' table.

Imperial measure has the advantage over apothecaries' of being exactly correlated to a system of weights, namely, the *avoirdupois*, which, as already seen, is, in part, the system of weights of the British Pharmacopœia. The correlation is, as usual, by the medium *water*, an imperial *fluidounce* of that liquid weighing exactly an ounce *avoirdupois*. Yet it must be carefully noted that in spite of this coincidence an imperial *minim* does not weigh exactly a *grain*; this for the evident reason that an imperial *fluidounce* divides into 480 *minims*, while its equivalent, the *avoirdupois ounce*, contains but 437.5 grains.

Metric measure is shown in the table on page 73.

prescription, to order every thing,
alike, by weight.

Concerning metric measure, the points to be
are, first, that it shares with metric measure the
conveniences inherent in a systematic relation
between the denomination-values, and secondly,
that it is exactly correlated with this relation by
weight through the usual fluid selection
correlations, namely, distilled water.
(cubic centimeter) of distilled water at
density weighs precisely a gramme, for the
reason that, in devising metric weight, the
weight of that measure of water was chosen
to afford the standard unit of weight in the
system. In the case of water, therefore, for
prescription-purposes, in the case of other
specific gravity is not far different from
water, the gramme, in weight, affords a

grains, drachms, and ounces, the titles *minims*, *fluidrachms*, and *fluidounces*, respectively; and for grammes the title *cubic centimeters* (milliliters).

TABLE OF "METRIC," OR FRENCH DECIMAL MEASURES OF CAPACITY.
(Rarely used in the prescribing of medicines.)

Milliliter (Cubic centi- meter). C.C.	Centiliter.	Deciliter.	Liter.	Decaliter.	Hecto- liter.	Kiloliter.	Myria- liter.
10	— 1						
100	10	— 1					
1,000	100	10	— 1				
10,000	1,000	100	10	— 1			
100,000	10,000	1,000	100	10	— 1		
1,000,000	100,000	10,000	1,000	100	10	— 1	
10,000,000	1,000,000	100,000	10,000	1,000	100	10	— 1

the integer, in notation, of weights. Quantities by measure and by weight can thus, metrical be written in column together, the suffixes " C. and "Gm." respectively indicating whether measure, in terms of cubic centimeters, or weight, in terms of grammes, is meant.

Of the measures *in domestic use* for dealing with medicines, the smallest is the time-honored drop. But the drop, though so commonly employed in the mensuration of medicines, is not, in the technical sense of the word, a measure at all, since its size differs enormously under different conditions, being affected not only by the viscosity of the fluid operated upon, but also, severally, by the shape, the surface-area, and even the position of the tip, of the dropping utensil. In general, large drops result in the case of fluids, and of droppers that preserve

of course, comparatively small drops will rule in cases where these conditions, severe reversed. As already hinted, an important factor in determining the size of the drop is, the common case of the pouring, by drops, from a medicine-vial, the *degree of tip* of the lip at the time of the pouring. For when, in the case when the vial is quite full, the contents begin to run out before the tip reaches the horizontal, the fluid running over the lip collects, by dripping, in the re-entrant angle formed by the projection of the lip from the neck of the vial, and there, finding a concave nidus to cling to, does not fall until, comparatively, a goodly quantity has accumulated. Hence, when the fall occurs, the drop is, comparatively, a large

one. In the case, on the other hand, of a half-empty vial, the fluid does not begin to run until the tip of the lip reaches the horizontal, under which circumstance, having only the narrow and convex edge of the lip itself to cling to, it falls, perforce, upon the delivery of a comparatively small quantity—that is, in comparatively small drops. Hence it is about that, even in the case of an identical quantity of medicine, the dose administered, if given by dropping directly from the vial, is very different in dimension according as

Experiment
will yield, of an identical fluid
half as large again as that re-
vial is half-empty. If, therefo-
measured by drops, a pipette
orifice should be used as the
instead of the lip of the vial.

plan, in the case of medicines w
is as follows: Let the *aggregat*
number of doses be measure
way, as by use of a proper g
pipette, and then let such ag
an identical number of spoonf
measured with an individua
the proportion, in volume, o
be, as it commonly will be
assumed, quite insignificant
dilution, made in the mann

is absolute dimension. Of course, from what already been said, it is clear that no single dimension will represent this ever-varying quantity, but, so far as averages go, it is convenient to reckon on the equivalences, respectively, of a minim over a minim for the drop of an aqueous fluid; from one-half to three-fourths of a minim for the drop of a tincture, a spirit, or a volatile oil; and a smaller proportion yet for that of an oil of a real body. The drop in the case of *chloroform* is much smaller because of the conjoint high tenuity and high specific gravity of this particular fluid, exceptionally small—as many as from 180 to 270, according to the conditions of the dropping, being required for the measure of a fluidrachm.

The *spoonful*, like the drop, is a very variable quantity, both on account of the faulty shape of the spoon-bowl for measuring purposes, and also on account of the very variable size of spoons themselves, even of the same denomination. The spoon, therefore, should be limited, in use as a measure of capacity for medicines, to mixtures of comparatively indeterminate dosage.

As to dimension, the average *teaspoonful* of the day runs six to the fluidounce, the *dessertspoonful* runs eight to the fluidounce, and the *tablespoonful* runs twelve to two fluidounces, or six to four. In metric measure, the dimension of the *teaspoonful* is, on

four cubic centimeters, the dessertspoonful, or fluidrachms, and the tablespoonful, or ounce, or sixteen cubic centimeters; however, it is safer to compute prescriptions if doses are to be measured by the smaller basis of the larger equivalents first.

A *wineglassful*—a very vague term of measure, held to mean the capacity of a sherry-glass, or about two fluidounces (cubic centimeters). The *cupful* rates from five to five fluidounces, and the *tumble* from eight to ten or twelve, but all these are so in size as to be worthless as measures for exact purpose.

CHAPTER V.

THE PRESCRIBING OF MEDICINES.

THE topic of the *prescribing* of medicines presents for technical study three distinct subjects, which, in logical sequence, are as follows: first, how to *compose* a prescription; secondly, how to *compute amounts* of ingredients; and thirdly, how to *write the document* in proper form and language.

I. *The Composing of a Prescription.*—Broadly considered, the subject of the composing of a prescription—meaning by the term the art of properly selecting the constituents of a composite medicament—embraces the consideration of the properties of the various articles of the *materia medica* in all their chemical, pharmaceutical, and physiological relations. Such consideration is, of course, not in place here, but there are yet certain general principles, bearing on the proper selection of the ingredients of prescriptions, whose discussion forms part of the technology of prescribing.

Proceeding to this discussion, the first point to be made is that a given prescription should be

the circumstance that the patient stands in need of medicinal attack from more than one point. Having, then, a single, definite purpose in view, the next point is the question whether such purpose will be best fulfilled by a single drug of the proper category, or by a mixture of such drugs. No general rule can be laid down in this regard, since, as a matter of fact, sometimes the one condition of the other. Thus, for example, in the one class of remedies, cathartics, some, such as the purgative oils, which work best when given singly, while others, as the resinous cathartics, operate more

reason than that it utterly defeats the exact clinical study of the therapeutic powers of drugs.

Assuming, then, that the active member, or team of members, of a prescription has been decided upon, the next consideration that presents is whether the medicinal action of the same can be rendered either, on the one hand, more *effective*, or, on the other, more *kindly*, by associating with the active medicine some drug of other quality. If such result can be so attained, then, of course, such association should be prescribed, on the principle of always aiming to secure, in the case of medicines, a maximum of therapeutic effect with a minimum of by-derangement. Now, as a matter of fact, it is quite often possible thus to enhance or to modify the medicinal action of a drug, so that a knowledge of such possibilities is essential to skilful prescribing. These modifications of the natural operation of a drug may result from a chemical or physical change wrought by another constituent of the prescription upon the active drug itself, or they may be effected by physiological impressions upon the subject. An example of the former kind is afforded by the action of a *solvent* in making more sure and speedy the absorption, and therefore the medicinal operation, of a salt; and of the latter, by the neutralization of the griping wrought by the rougher

criptions for the purpose of making n
the operation of the medicine, are suc
as are designed, in the case of fluid m
improve the taste.

Obviously a medicine should be no n
need be, but, even apart from the c
general propriety, the matter of the
medicinal mixture has most importan
bearings. For an unsavory potion
upset the sensitive stomach of an invali
always deplorable, and, under certa
stances, possibly serious also ; and, in
children, an offensive dose leads to
warfare, with, perhaps, disastrous res
tient and physician, both. For the
the making of a mixture to be as
possible to eye, nose, and palate, all,

to make the same a matter of no moment. Now, the things to add to fluid medicines to cover taste are mainly *sugar* or *syrup*, or preparations from pleasantly flavored aromatics—viz., the syrups, waters, and spirits derived from those drugs, or a minute dash of their essential oils. Lists of the pleasantly flavored waters, spirits, and syrups of the Pharmacopœia were purposely detailed when speaking of forms of medicines. A judicious use of these flavoring agents may not only make a potion less nasty, but may prevent its sickening, and so have a really important influence on the therapeutics of the active drug.

A third consideration, in the selection of the members of a prescription, relates to such constituents as may be necessary to *effect solution*, to *afford volume*, or, as in the case of the excipient of a pill-mass, to *determine form*. Evidently the selection of substances for these several purposes can follow no fixed scheme, but must be determined in each instance by the considerations affecting the individual case.

On review, it thus appears that a prescription may, with propriety and possible advantage, comprise constituents for the fulfilling of the three separate aims, respectively, of, first, producing the desired *medicinal impression*; secondly, improving the *quality* of such impression by either

to the several members of a prescription ing to their respective purposes, we member, or team of members, that is t medicinal work, the *basis*; that which the working of the basis, the *adjuvan* which corrects some disagreeable by-effe same, the *corrigent*, or *corrective*; and th gives volume or form, the *vehicle* or the e respectively.

A general consideration affecting the of the members of a prescription is the p regard must be had to the chemical and physical properties of the substances for association, lest, inadvertently, u reactions be determined. For things wh the purely therapeutic point of view, mi well fitted for combination in the same tion, may yet easily be of such chemical t

1. *Acids and bases tend to combine, forming salts.* This reaction may be utilized in order to get some salt that may be needed; but, if *free acidity or alkalinity* be aimed at, acids and bases must not be prescribed together.

2. *Strong acids or bases generally displace their own weaker brethren when met with in saline combination.* Here the word "generally" is used advisedly, for, under the circumstance that an *insoluble* salt will result, the reverse may obtain, and, through chemistry's imperious passion for precipitates, a weaker acid or base may displace a stronger. Ordinarily, however, the fact is as stated, and its bearing on prescription-combinations is obvious.

3. *Salts in solution exchange radicals, or acids or bases displace their brethren in saline combination, if, thereby, an insoluble compound can be formed.* This is a fact in chemistry that quite generally obtains, and whose bearing on prescribing is important. In the first place, the reaction may be a convenience, of which we actually avail ourselves as a means of getting a thing that we happen to want in condition of precipitate. The well-known *black* and *yellow* washes of mercury are examples in point. In the second place, the reaction may make no practical difference in either medicinal activity or other qualities of the com-

cause a precipitate occurs in the case of the admonisher forgetting that the activities of the alimentary apparatus dispose of a precipitated substance as of one in actual solution.

In the third place, however, the reasons make a most important difference, either the precipitate is difficult of solution by the fluids, and therefore is medicinal inert, or because the presence of the precipitate as such, in the mixture is unsightly, or the same awkward or dangerous for administration. The more prominent of mutually precipitations are shown in the table on page 10. The precipitates accredited to solutions of the alkaloids and the metals occur with the generality of those bodies, though not

salts, tend, as a class, to dissolve much in *alcohol*; while, on the other hand, *volatile oils* and *resins*, including *balsam of sulphur*, tend to dissolve in alcohol, and are either soluble or not at all in water.

5. *Powerful oxidizing agents make explosions on concentrated admixtures with oxidizable substances.* The medicinal powerful oxidizers are *chromic acid* and *nitrohydrochloric acids*, and *potassium permanganate*, and the most combustible bodies are *oils*, *alcohols*, and *ether*. Among the alcohols *glycerin* and *alcohol* chemically belong to the *alcoholic* *organic* substances generally, *sulphur*. Not all of these combustible substances are treated with all of the ox-

individual substances concerned. Many things, even such as corrosive sublimate or syrup of ferrous iodide, are, chemically, so very vulnerable that the practical rule obtains to associate with them, in prescribing, nothing but plain water.

Passing now from the principles affecting the composing of a medicinal combination, we should logically next discuss the art of computing amounts. Inasmuch, however, as in actual practice it is the custom—and a wise one—to write down the titles of all the constituents of a prescription before proceeding to calculate quantities, we shall find it more convenient, in study, to follow the order thus suggested, and to leave, therefore, the consideration of the computation of amounts to the last. We proceed, then, at once to the twofold topic of the *form* and *language*, or, to phrase it simply, the *expression* of a prescription.

II. *The Expression of a Prescription.*—In *form* a prescription begins with the *name of the patient* for whom the medicine is ordered; then follow the *directions to the pharmacist* of what ingredients to take and how to compound them; next, a transcription of the desired *labelling* as to dose and frequency of giving; fourthly, *date* and *signature* of the author; and fifthly, any special order concerning the prescription itself, such as

Now, concerning these sever
scription, the following genera
be made. The *name of the patient*
be entered upon the prescription
against a possible mistake—on t
the dispenser, in delivering the
the customer, or, on the other, of
ministering the wrong medicine
supposing, as may happen, that t
tients are at the same time under
The *directions for compounding*,
next, should be written *deliberate*
fully, under the consciousness that
pen" may cost a human life—
with

paper, the *directions for the taking*, which the dispenser is to transcribe upon the label of the package, should, for the same reason of seeking all possible surety against mistakes, be written fully, intelligibly, and, of course, again, legibly. The empty phrase, "use as directed," so often senselessly ordered to be entered in lieu of the directions themselves, is as solemnly absurd as it could be a legal contract reading "we hereby agree to do as we have agreed"; and, of course, amounts to letting the bottle be launched, labelless, upon its errand, to work weal or woe, according as human forgetfulness and misunderstanding may chance to determine. The fourth feature is *date* and *signature* of the prescriber—a feature that should as invariably appear in a prescription as in any other document having a business-bearing. Fifthly, the special directions concerning disposal of the prescription, considered as a piece of property of its author, are, of course, at the same author's discretion.

So much in a general way. And passing now to matters of detail, we need discuss only our second part of the prescription, namely, that which constitutes its body—the directions for the compounding of the medicine. This is, in form, a straightforward order telling the compounder to take such-and-such things and do so-and-so

z quantity of *U*, etc.
Do so-and-so [with them].
Label [the package] : "..."

In setting down the titles of the ingredients in the natural order is followed of writing the *basis*, or series of bases, next for the *flavoring agent*, and, fourthly for the *corrigent*, and, fourthly for the *vehicle*—flavoring agent first, inert

Disposing thus of *form*, we pass to the important matter of *language* of the prescription. So far as concerns the entering of the prescription in the patient, the writing out of the prescription for administration for copy upon the label, the dating and signing, and the enjoined observance about the prescription—are, in the United States, quite generally and entirely properly written in the ver-

in Latin. A certain knowledge of the Latin language thus presents itself as a necessity to the prescriber, and to the medical student unfamiliar with that tongue looms a very mountain of untold terrors, whose pathways he despairingly makes no attempt to tread. But be it ours to reassure the faint-hearted traveller—the difficulties are neither so many nor so grave as he fears. For apart from the vocabulary of titles of medicines, which, of course, must be learned by rote, the words and phrases of prescription-usage are few, and the forms so set that a very little of etymology and syntax suffices for proper rendering. The student with no knowledge of Latin is, therefore, earnestly urged to master so much of the vocabulary and grammar of that tongue as may save him from disgrace before latinist patient or pharmacist on each occasion of his issuing a prescription. So much of Latin, then, if to be learned, must be taught, and to such teaching we will without further apology betake ourselves.

Reverting to our formula, we brush away with one sweep, so far as latinizing is concerned, fully one-half the wording, by the custom of expressing invariable or oft-recurring words or phrases by abbreviations or arbitrary symbols. Thus, as follows: the verb "take," which begins the

formerly used to symbolize a prayer to Jupiter for divine blessing upon the ordered. Next, the words concerned *quantity* are also invariably symbolized in the apothecaries' system, by the emblems of the established denomination-symbolizing the expressing of numerals, Roman for small letters of the alphabet written as a symbol ; and, in the case of the metric system, the use of ordinary Arabic notation in the style, with the abbreviation "Gm." for gram, or "C.c." for *cubic centimeter*, followed by the numeral. Lastly, the word "label" is symbolized by the abbreviation "S.," being the initial of the Latin word *signa*, "mark [the

We are thus happily narrowed down to the enumeration of ingredients, on the one hand

indeed, does the word "mix" occur as the entirety of the order, that it too is commonly symbolized, being expressed by the abbreviation "M.," the initial of the word *misce*, "mix [thou]." For the rest, the commonest occurring phrases can be correctly latinized by the use of the following vocabulary in connection with a previous knowledge of the technical titles of forms of medicinal preparations, and by the application of the usages of Latin etymology and syntax shortly to be expounded. Should, however, any pharmaceutical procedure require to be detailed in prescription, too complicated for the latinizing of its statement by the aids thus offered, then let the prescriber quietly "drop into" English for that sentence. Not only would this doing be permissible, but it would, in this country, be even advisable, lest unusual Latin "stump" the *pharmacist*, to the confusion of prompt and faithful compounding.

TABLE SHOWING ODD WORDS OCCURRING IN
PRESCRIPTION-PHRASES.

I. *Verbs, imperative*, object to be in the accusative case (analogue of English "objective").

<i>A'dde</i> , add.	<i>Fac</i> , make.	<i>Re'cipe</i> , take.
<i>Co'la</i> , strain.	<i>Fil'tra</i> , filter.	<i>Si'gna</i> , mark.
<i>Di'vide</i> , divide.	<i>Ma'cera</i> , macerate.	<i>So'lve</i> , dissolve.
<i>Exte'nde</i> , spread.	<i>Mi'sce</i> , mix.	<i>Te're</i> , rub.

Fl'at (singular), *Fl'ant* (plural), let [it, into].

III. *Verbal adjective* (participle), to its noun in gender, number, and case

Divide'nd-us (masculine), *-a* (feminine), to be divided.

IV. *Prepositions*, following noun in accusative case :

Ad, to, up to. | *In*, into. | *Su*

V. *Prepositions*, following noun in ablative case :

Cum, with. | *Pro*

VI. *Miscellaneous words and phrases*

<i>A'na</i> , of each (Greek).	<i>Gutta'tim</i> ,
<i>Be'ne</i> , well.	<i>Non</i> , not.
<i>Bis</i> , twice.	<i>Se'mel</i> , once.
<i>De'in</i> , thereupon.	<i>Si'mul</i> , together.
<i>Et</i> , and.	<i>Sta'tim</i> , at once.
<i>Grada'tim</i> gradually.	<i>Ter</i> thrice.

any serious trouble, namely, the enumeration of the medicinal things which the compounder is to take. Here, so far as mere vocabulary is concerned, the words are, of course, numerous, and the what means what and the correct spelling thereof are things that must, of necessity, be learned by rote, by hard "digging." But the technicalities with which we have here to deal are those of the how properly to fit our words together to mean what we want to say with them. We may find in the dictionary that *compositus* means "compound," *extractum* means "extract," and *colocynthis* "colocynth," but yet how shall we say "compound extract of colocynth," in good Latin, in ordinary statement, on the one hand, and in the special prescription-phrase to "take x quantity of 'compound extract of colocynth'" on the other? Again let the novice take heart; though the words are many, the amount of etymology and syntax required for their proper setting is not more than a bright mind can grasp, in the principle, in an hour. Then a little daily practice with the tables to be exhibited will soon make of a willing apprentice a good *terminological* expert!

Let us now take a few examples of medicine-titles and analyze their construction :

Wine of root of colchicum.

Mercury with chalk.

Here we find that we have to deal and, occasionally, *adjectives*; that noun of a title is in the *nominative* that the dependents are in the *objective case* them following the preposition "of". One ("chalk") follows the preposition. Let us see now how the same will be in a prescription-phrase:

"Take, x quantity of compound extract of
colocynth,
 y quantity of sulphate of quinine"

Evidently here the dependent nouns
"colocynth" and "quinine," remain
in relation but evidently on the other

consider certain prescription-forms occasionally arising :

“Take, x quantity of oil of castor,
The yolk of one egg.”

Or again :

“Take, x quantity of A,
 y quantity of B,
water, as much as needed to make the
mixture measure z quantity.”

In both of these examples we find that the last entry does not read to take a given *quantity of* the thing, but to *take the thing itself*—the *yolk* in the one case and *water* in the other. Here, then, the words “yolk” and “water” are not in the objective after *of*, but in the objective without a preposition, as the immediate “objects” of the verb *take*.

Our analysis of English titles shows us, thus, that we need, in the way of grammar, to know how, given a nominative, to form the expression for : (1) objective case after *of*; (2) objective case after *with*; (3) objective case following a verb. Now, in Latin, case is expressed, as in the English “possessive,” by modification of the *ending* of the word, and, in Latin, each of the conditions of case cited above constitutes an individual “case,” expressed by individual ending. Our examples,

lent to Latin *ablative*; English *objective verb*, equivalent to Latin *accusative*. there are also two other cases, *dative* and *genitive*, but these do not occur in prescription.

The whole technicality, then, of prescribing medicine-titles in Latin, and of setting such titles under the syntax-condition of prescription-phrasing, resolves itself into the direct changing of ending of the dictionary-fit expression of *case*. But, unfortunately, by no means the simple affair it is in English. In English, the whole matter is a simple matter of ending for a single case (possessive) and no modification whatever for adjectives. In Latin, each of the several cases has a special ending, and this for adjectives as well as for nouns; there are, furthermore, five different schemes of forming such case-endings.

possess ! Here, then, is complexity, and in this complexity resides the whole practical difficulty of the latinizing of prescriptions. To thread the labyrinth thus presented, we see that we need to know three separate things : *First*, the several schemes of forming case-endings—the *declensions*, in short, in order to get always the proper inflection for a given “ case ”; *secondly*, the system by which, with a given noun in the nominative, we are to recognize the declension to which such noun belongs; and, *thirdly*, the system by which we are to know *genders*, in order to tell, with a given noun, by what declension and subdivision thereof to inflect any adjective we may propose to attach to the same.

First, of the *declensions*, or schemes of forming case-endings. As already said, there are five such, but of these one—the fifth—offers, in ordinary prescription-vocabulary, but a single example, viz., the ablative case *re*, in the phrase “ *pro re natâ*,” meaning, in free translation, “ as necessity arises,” referring to indications for dosing. We need, then, to know but four declensions, and, of these, only the inflections for the cases concerned in prescription-writing, namely : in the singular number, the *nominative*, *genitive*, *accusative*, and *ablative*; and, in the plural number, *nominative*, *genitive*, and *accusative*. Following is a table of such parts:

TABLE OF PARTS OF DECLENSIONS
Concerned in Prescription-Latin.
Nouns and Adjectives.

1ST DECLENSION.	SECOND DECLENSION.	THIRD DECLENSION.	1ST DECLENSION.
	m. n. m. and f. n.		
	<i>Singular Number.</i>		
(e)	-us(-os)	-um(-on)	(various) (various)
(es)	-i		-is
(en)	-um (-on)	-em	(like nom.)
	-o	-e	
	<i>Plural Number.</i>		
	-i	-a	-a
		-es	

Cardinal Numerals.

	<i>m.</i>	<i>f.</i>	<i>n.</i>	<i>m.</i>	<i>f.</i>	<i>n.</i>	<i>m. and f.</i>	<i>n.</i>
Nominative....	un-us	-a	-um	du-o	-æ	-o	tr-es	-ia
Genitive		-ius		-orum	-arum	-orum	-ium	
Accusative.....	-um	-am	-um	-os	-as	-o	-es	-ia

INDECLINABLE.

Alcohol,	Elixir,	Naphtol,
Amyl,	Eucalyptol,	Pyrogallol,
Buchu,	Kamala,	Salol,
Cajuputi,	Kino,	Sassafras,
Catechu,	Matico,	Sumbul,
Chloral,	Menthol,	Thymol.
Cusso,	Methyl,	

And cardinal numerals signifying a higher number than *three*.

natives of second declension in *er*, and of
 in *u*; ablative singular of third declension
 and neuter plurals in *ia*, etc.; the object
 in the table as in the text, to restrict the table
 to only so much of latinity as is actually
 in prescription-writing. In the table, the
 of nouns of different endings, so far as they
 determinable by the ending, are expressed by
 abbreviations *m.*, *f.*, and *n.*, meaning *masculine*,
feminine, and *neuter*, respectively; and terms
 enclosed in *parenthesis* are those of nouns
 which have been adopted into Latin somewhat
 of their original Greek dress.

In applying this table the case-endings of
 nouns and adjectives are appended to the
 called *root* or *stem* of the word, which, in
 of the first, second, and fourth declensions,
 found easily enough by subtracting *e*

dem, *cantharide*, *cantharides*, show plainly the root or stem "cantharid-" while, yet, the nominative is *cantharis*, a form whose dissection fails to show the root. The third declension thus has this peculiar disability: that, knowing the nominative, we cannot therefrom always deduce the genitive, and hence must, in the case of members of this declension, do the double memorizing of nominative and genitive. The declension of *cardinal numerals* is irregular in the case of *unus*, "one," and *duo*, "two," but *tres*, "three," takes the regular endings of the third declension, plural. All other cardinal numerals are indeclinable, as are also, as the table shows, certain words of "barbarous" origin, adopted into Latin without a Latin dress, and hence necessarily exempted from Latin inflections. With all indeclinable words there is no change, in any case, from the spelling of the nominative.

Next, as regards *genders*. Gender of nouns is in Latin determined by two independent considerations, one being the nature of the thing signified, and the other the ending and declension of the noun; and of these considerations, if they conflict, the former takes precedence. That is, if a noun by its declension-ending ought to be masculine, but yet signifies a thing regarded in Latin idiom as intrinsically feminine, that noun will

the names of which, by a Latin-*as* feminine nouns, no matter what the endings. Yet here the point must be that the rule obtains only in *ancient Latin names*, such as *quercus*, "oak," *ulmus* etc., the technical Latin botanical modern invention, signifying trees, natural gender of their declension-ending while, as just cited, *ulmus* is feminine, *quercus* is masculine. This whole matter hardly merits the time it takes for it since the number of tree-name nouns in description-occurrence that are thus feminine, when they ought to be of the other gender, are very few, and of them but a few drug-titles, followed by an adjective, require attention to be paid to the gender. The full list of such classical tree-names

ana, *quercus* with adjective *alba*, *rhamnus* with adjective *Purshiana*, and *rhus* with adjective *glabra*.

Disposing thus of the bearing of signification upon gender, for the rest the genders of nouns are determined by declension-ending, and a study of our declension-table shows that for all declensions, except the troublesome *third*, again, each form of nominative case-ending carries with it a special gender. Thus all (prescription-used) nouns of the first declension are feminine, and those of the fourth (excepting, of course, the tree-name nouns just cited) masculine; while in the second declension all nouns in *-us* (certain tree-names excepted again) are masculine, and in *-um*, neuter. As to third-declension nouns, the various endings of this declension give all genders, and, unfortunately, all nouns of the same ending are not always of the same gender. A little hard memorizing thus becomes necessary here, but only a little, for happily in very many instances all nouns of a certain ending and genitive-formation take the same gender, and, with the majority of those whose genders are arbitrary, prescription-usage does not require the gender to be known. The most prominent instance of a natural group of nouns of the same gender is in the case of nouns in *-as* forming genitive in *-atis*, and nouns

pœias, settled down, in the sixth re-
own authority, into masculine.
indeclinable nouns, these are all neu-

For the *determining of declension*,
declinable nouns, a table is conveni-
show, for each nominative singular
declension and gender of such Latin
cur in pharmacopœial medicinal tit-
mon prescription-use. Such a table
on pages 110-114. In this table, all
third declension—the one so trouble-
of diversity of genitives and gender
logged in full under their several nomi-
ings, and the genitives given in parentheses
genders also are given throughout
ness' sake, although, as already said,
to be known only in the minority
Genders are designated by the abbreviations

concerned in prescription-writing will be found on page 115.

Concerning the scheme shown in the table we may note the following : Scheme I. embraces the very great majority of adjectives, and the neuter ending *-on* instead of the usual *-um* occurs in but a single example, *diachylon*. Scheme II. comes next in order of membership, such adjectives as *mitis*, "mild," *mollis*, "soft," belonging to this family. In the neuter of this scheme we have examples of words in *-e* of the third declension—words not occurring among pharmacopœial nouns. Scheme III. is a peculiar scheme for declining the "comparative" of certain adjectives, and presents for us but a single example, *fortior* (masc. and fem.), meaning "stronger." Scheme IV. has, in our present Pharmacopœia, but two examples in *-ens*, *effervescens* and *recens*. Viewing the schemes together, we see that the nominative-ending carries with it the showing of declension and gender in all cases.

DECLENSION AND GENDER OF LATIN NOUNS
 OF U. S. PHARMACEUTICAL MEDICINES AND
 COMMON PRESCRIPTION-TERMS.

Nominative Singular ending in -a :

Declension and Feminine, except Kamala, indeclinable and (of Greek origin) the following in -ma :
 (phystosi'gmatis), 3d, E'nema (ene'matis), 3d, *
 Catapla'sma (catapla'smē),
 Gargari'sma (gargari'smē),
 Theobro'ma (theobro'mē)

Nominative Singular ending in -us :

All Second Declension, Masculine, except—

Rhus (rho'is), 3d, f. ("f.")
 Fru'ctus, 4th, m.
 Spi'ritus, "

Comprise only the following—

Flos (flo'ris), 3*d*, *m*.

| Bos (bo'vis), 3*d*, *m*. or *f*.

Nominative Singular ending in -um :

All Second Declension, Neuter.

Nominative Singular ending in -on :

Comprise only the following—

Eriodi'ctyon, 2*d*, *n*.

Hæmato'xylon, "

Toxicode'ndron, "

| Eri'geron (erigero'ntis), 3*d*, *n*.

| Li'mon (limo'nis), 3*d*, *m*.

Nouns of all other endings are of the Third Declension, and are as follows :

Ending in -c :

Lac (la'ctis), *n*.

ING DECLENSION AND GENDER OF NOUNS (Co

Ending in -el :

| Mel (me'llis), *n.*

Ending in -en :

(nis), *n.* | Se'men (se'minis), *n.*

Ending in -o :

(-io)

(-ago)

ectio'nis), *f.*

Mucila'go (mucila'ginis),

Comprise only the following—

Flos (flo'ris), 3*d*, *m*.

| Bos (bo'vis), 3*d*, *m*. or *f*.

Nominative Singular ending in -um :

All Second Declension, Neuter.

Nominative Singular ending in -on :

Comprise only the following—

Eriodi'ctyon, 2*d*, *n*.

Hæmato'xylon, "

Toxicode'ndron, "

| Eri'geron (erigero'ntis), 3*d*, *n*.

| Li'mon (limo'nis), 3*d*, *m*.

Nouns of all other endings are of the Third Declension, and are as follows :

Ending in -c :

Lac (la'ctis), *n*.

DECLENSION AND GENDER OF NOUNS (Contd.)

Ending in -s (continued) :

itive -idis)

nidis), *f.*

'ridis), *f.*

y'nthidis), *f.*

me'lidis), *f.*

f.

(-ns)

Ju'glaus (jugla'ndis), *f.*

(-ps)

A'deps (a'dipis), *m.*

(-rs)

Pars (pa'rtis), *f.*

Ending in -x :

ux)

m.

(-ix)

Pix (pi'cis), *f.*

TABLE
Showing Schemes of Declension and Gender of Adjectives occurring in Pharmacopœial Medicinal Titles and in Prescription-Phrases.

macopœial Medicinal Titles and in Prescription-Phrases.

Neuter.
um (-on) [2d dec.]

Feminine.
a [1st dec.]

Masculine.
us [2d dec.]

SCHEME II.—Third Declension.

Neuter.
e (genitive -is).

Masculine and Feminine.
is (genitive -is).

SCHEME III.—Third Declension.
Masculine and Feminine.
or (genitive -oris).

SCHEME IV.—Third Declension.

All Genders.
ens (genitive singular -entis) ; (genitive plural -entium).

original prescription-formula, we see the wording is, *take x quantity of A*. Now in Latin, would read, *take, of A, quantity*. In such Latin order, as is well known, is used in prescription-writing. Again, such as *leaves of belladonna* would, in Latin, be words reversed in order, reading, *of belladonna the leaves*. Such Latin order is commonly followed in the latinizing of titles of preparations, except that, in the case of pharmaceutical preparations, the word signifying the preparation—tincture, extract, etc.—is placed dependent, as in English. Hence we see the incongruity of the titles, *opii pulvis*—"powder of opium"—a condition of opium; *tinctura opii*, "tincture of opium"—a preparation from the drug. Another point is the

calities here are arbitrary, it is best not to rest with their mere general exposition, but to fix our newly acquired knowledge by working out a few examples. This we will do, then, in this place, leaving the matter of *quantities* for future consideration.

We wish to order for Mrs. A. B. a stomach-bitter, and we select *quinine sulphate*. Forthwith, then, we set down the phrase "For Mrs. A. B.," and follow it with the order "take of sulphate of quinine"—as yet not fixing the amount. Having got thus far, we bethink us in what pharmaceutical form this quinine salt shall be given, and we determine upon the fluid form, and that the salt shall be in actual solution. Then occurs the chemical point that quinine sulphate needs the help of an acid to dissolve it in ordinary fluids, and so perforce we must add an acid to our prescription; we elect to take *aromatic sulphuric acid*, and so write next the words [take] "of aromatic sulphuric acid"—a quantity to be determined by the amount of quinine. Next we turn our thoughts to the ingredients to make up the fluid vehicle in which the quinine salt is to be dissolved. This is to be essentially aqueous, but it occurs to us as a desideratum to have it sweetened by a pleasant syrup in proper proportion. We add, therefore, the words [take] "of syrup of

suggests itself to us to take,
an aromatic water, in order still further
prove taste. We select *water of orange*
and may write for this in one of three ways
may, as in the case of the other ingredients
[take] "of water of orange flowers" the
quantity, or we may say [take] "water of
flowers up to the total measure of" the
to be occupied by the mixture, or, again,
water of orange flowers as much as may be
sary to attain" the same total bulk. In
necessary pharmacy in the case being for
the simple mixing of the ingredients, we use
the word "mix," and follow with the
"mark [it] :—'Teaspoonful thrice daily
eating.'" Then we date and sign
and, if we please, order it "not to be
better. we use private

EXAMPLE I.—

Not to be Renewed.

For Mrs. A. B.

Take, Of Quinine Sulphate [quantity x],
Of Aromatic Sulphuric Acid [quantity y],
Of Syrup of Almond [quantity z],
Of Water of Orange Flowers [quantity w],
Or, Water of Orange Flowers up to [the measure of] [quantity n].

Or, Of Water of Orange Flowers as much as may be necessary to [attain the measure of] [quantity n].

Mix. Label—"Teaspoonful thrice daily before eating."

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August 25, 1894.

To latinize, we find that the dictionary-words for *sulphate* and *quinine* are, respectively, "*sulphas*" and "*quinina*," and that our English model shows that both must be, as usual in prescription-form, in the *genitive*. Turning to our table showing guide to declensions, we find "ending in *-as*, genitive *-atis*, *acetas* (*acetatis*) and all salt names in *-as*." Evidently, then, *sulphas* belongs to this category, and its genitive, therefore, is *sulphatis*. As to *quinina*, the table declares all

and thus make from *quinina*, *quininæ*.
ingly we set down the first line of our e

B. *Quininæ Sulphatis*.

The next entry, "aromatic sulphur" offers a *noun*, "acid," with two modifiers, "aromatic" and "sulphuric." then, in the case of the word for "acid" must have regard to *gender* as well as to *sion*, in order to know how to dress theatives. The dictionary gives for "acid" *um*," and our table declares all nouns in be of the *second declension*, and of *neuter*. The declension-table next affords *genitive* so that "of acid" becomes *acidi*. Turn to the adjectives, we find that "aromatic" "sulphuric" are, respectively, in *dic naming in Latin* *aromaticum* and *sulphuricum*.

nominative, *aromaticum* and *sulphuricum*; but since they must follow their noun, not only in gender, but also in case and number, we must, in our prescription, turn these nominatives into genitives singular to obey the condition imposed by genitive singular noun *acidi*. So, then, *aromaticum* and *sulphuricum*, being forms in second declension, exactly as *acidum* itself happens to be, make, like *acidum*, genitive in *i*, and so become, respectively, *aromatici* and *sulphurici*. Then, as to order, adjectives in Latin follow their nouns, and the one of closest relationship takes precedence. The English order, then, suffers exact reversal, and the line must read:

Acidi Sulphurici Aromatici

Next is the entry, of "syrup of almond," a phrase presenting two nouns in the genitive. "Syrup" is *syrupus*, and our table shows nouns in *-us*, with a few exceptions, to be of the second declension. "Of syrup" then becomes *syrupi*. "Almond" is *amygdala*, which, ending in *-a*, like *quinina*, plainly is of the first declension, and makes genitive, therefore, *amygdalæ*. As to order, here we have a *pharmaceutical preparation* to deal with, in which case, as already pointed out, we cling to the English order, and let the

of orange flowers, which, we have
pressed of water of flowers of orange—thus
in the genitive, and one of them, “flower”
plural number. *Aqua*, “water,” given
may now divine without referring to the
aquæ for its genitive. “Flower” is *flos*
table of endings cites *flos* as being of
declension, genitive *floris*. To find the
plural, we revert to the table of declen
find the ending to be, generally, *-um*, t
plied to the root of the word. The root
of the third declension is found by su
the genitive singular case-ending, “i
tract, then, “is” from “*floris*,” the
singular, and we have, for root or “ste
to which affix the genitive plural case-en
and we have as the word we seek, *flor*
flowers.” “Orange” is *aurantium*, v

comes first ; but the pair of nouns " of flowers of orange " must behave with true latinity and range themselves " of orange [the] flowers," as, indeed, is in this case the common English idiom. The line then reads :

Aquæ Aurantii Florum.....

The second form of the same entry is " water of orange flowers up to [the measure of]." Here *water* becomes the immediate " object " of the verb *take*, instead of being, as before, a dependent upon the word for quantity. The case, then, must no longer be *genitive*, but *accusative*, and so from our declension-table we derive the accusative form *aquam*, which we must substitute for "aquæ." Next, the new form presents for rendering into Latin the phrase " up to [the measure of]." Turning to our table of odd words, we find the preposition *ad*, signifying " to," or " up to." The whole phrase then becomes :

Aquam Aurantii Florum, ad

wherein the words " aurantii " and " florum " suffer no change, for, of course, the phrase is still " water of flowers of orange."

The third form of the entry is " of water of orange flowers as much as may be necessary to [attain the measure of]." Evidently " of water"

quantum sufficiat, meaning "as much as necessary." Then the already found prep *ad*, "up to," completes the phrase, and in its third form becomes:

Aquæ Aurantii Florum, quantum sufficiat

But the phrase "*quantum sufficiat*," being a phrase of common occurrence, is, as usual in such circumstances, *abbreviated*, and is expressed by the initial letters of the two words of the phrase, thus—*q. s.* The abbreviated phrase in actual usage will then be:

Aquæ Aurantii Florum, q. s. ad. . .

Then the setting down of the symbols "*mix*," and *S.* for "label," completes the phrase.

Let us next illustrate other features

for this end it will not do, as in the previous example, to order a simple admixture of all the ingredients, for the reason that emulsification is a peculiar process which requires that the oil and emulsifier shall be rubbed together alone. When emulsification is accomplished, but until then, may we add the flavoring and coloring ingredients. Here, then, we have distinct steps in the compounding, which steps it to be properly detailed in the prescription. A prescription, then, would read, taking the use of an egg for the emulsifying agent, and a mixture of syrup of orange and spearmint water for the flavored diluent, as follows :

EXAMPLE II.—

For Mr. E. F.

℞ Of Castor-oil [quantity x],

The yolk of one egg :

rub well together : then add

Of Syrup of Orange [quantity y],

Of Spearmint Water [quantity z].

Let it be made into an emulsion.

℞—“ One-half at a dose.”

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August 26, 1894.

the oil and the egg-yolk until a good emulsion is formed. To translate now: "of castor" is *castorei* structurally, "of oil of castor"—*oleum castorei*—which we know enough now to turn a genitive *olei*; and for "castor" we have a special nomenclature, the genus-name of the animal furnishing the oil, namely, *ricinus*. As *ricinus* being, as is the case with the immense majority of nouns in *-us*, of the second declension, for "of castor," the genitive *ricini*. In other words, the oil, being, practically, a preparation of the English order "oil of ricinus" of the English order "oil of ricinus" of the entry appears:

R. *Olei Ricini*.....

Next comes the unusual phrase "one egg." Here, in the first place, the word *ovum* is plainly the direct object of the verb

elves genitive of noun *egg*, with which must be in gender, case, and number the numeral adjective *one*. *Orum*, "egg," like *acidum* of former example, will make genitive *ovi*, and will require its adjective to assume the neuter gender. *Unus*, "one," is peculiar in declension, and, as shown in full on our declension-table, makes genitive for all genders in the irregular forms *eorum*. In order of words the practice in inditing prescriptions is here generally followed, so that *unus* precedes *of egg*, though the adjective *one* follows the same. The translation is then :

Vitellum Ovi unius.

Next the pharmaceutical direction, "rub well together, then add," can be translated at once, by looking from the table of odd words, thus :

Tere bene simul : dein adde

"Of syrup of orange," the phrase which next comes, we can render by former experience at once :

Syrupi Aurantii

"Of spearmint water" means "of water of mint." "Of water" we already know to be *aqua*, and, for the official Latin name of *spearmint*, we have a translation of the words *green mint*. "Mint" is *mentha*, genitive, obviously,

to table of schemes of adjectives, that adjectives in *-is* have masculine in *-is*, which form is of the third declension in *-is*. *Viridis*, nominative, then also *viridis*, nominative feminine, gives *viridis* for the genitive of *Viridis* it is, then, and, adjective follows the whole reads :

Aquæ Menthæ Viridis.....

Lastly, comes the further pharmacopœia, "*Mix* : let it be made into a mixture." "*Mix*" becomes, as usual, *M.* ; "let it be made into" is found by the table of odd forms, expressed by the single word *fiat*, a verb in the passive voice, takes the form *fiat*, which the making is to be, as predicate. "*Emulsionem*." "*emulsion*" stands

in the case of soluble salts whose dose is considerable, we will give this medicine in solution, and it is agreeable so to flavor the draught that the same shall taste like lemonade. Now, the easiest way to get potassium citrate in solution is to *form* the salt by addition of potassium *carbonate* to a solution of free citric acid. In such mixture, the stronger citric ejects the weaker carbonic acid of the carbonate, and, taking the potassium to itself, forms potassium citrate, which salt remains in solution. So our procedure in the premises will be this : we will order a solution of citric acid, flavor the same with a little of the essential oil of lemon, the better to imitate lemonade-flavor, and then (chemically) *saturate* the solution with potassium carbonate—that is, add gradually the latter salt so long as the evolution of bubbles of carbonic acid gas shall show that some citric acid still remains free, ready for attack upon more carbonate. Now, for the flavoring with the drop or two of oil of lemon, we must, as in the emulsifying of the castor-oil in the last example, observe certain precautions. If we add the lemon-oil to the *solution*, whether before or after the addition of the potassic salt, such oil will, because of its great insolubility in water, not become well diffused throughout ; but if we rub it in a mortar with the dry crystals of

in this prescription, three distinct steps are required in the compounding, all of which, of course, be described in our order.

The prescription, then, will read :

EXAMPLE III.—

For Miss I. J.

Take, Of Citric Acid [quantity x],
Of Oil of Lemon [quantity y];
Rub together ; then add
Of Water [quantity z];
Dissolve, and add, gradually,
Of Potassium Carbonate as much as may
be necessary up to saturation.
Label—" A teaspoonful as occasion a

K. L.

agree with *acidum*, and then for the genitive, to signify "of citric acid," the form will be :

R. Acidi Citrici.....

Next, *oleum*, "oil," we have also had before ; *limon*, "lemon," requires reference to the table of endings, where we find the word cited as belonging to the third declension, genitive *limonis*. "Of oil of lemon" then becomes :

Olei Limonis.....

"Rub together : then add" has also occurred before, as thus :

Tere simul : dein adde.

"Of water," also of former occurrence, is *aquæ* from nominative *aqua* :

Aquæ.....

Next, "dissolve" is found by the table of odd words to be *solve*; "and" to be *et*, "add," *adde*, and "gradually," *gradatim*. Thus this next line reads :

Solve, et adde, gradatim.

"Of potassium carbonate" presents next. "Potassium" is *potassium*—all titles of metals in *-um* being embodiments into English of a Latin word. "Of potassium" is, then, *potassii*, and

[the] carbonate" then reads :

Potassii Carbonatis.....

Lastly comes the phrase, "as much necessary up to saturation," which, by cabulary of odd words, we render,

Quantum sufficiat ad saturandu

or, as before, abbreviating *quantum su*
full line reads :

Potassii Carbonatis q. s. ad saturan

A fourth example will illustrate points. We wish to give Mr. M. N. a sh of laxative pills, to be composed of equ "blue pill," aloes, and rhubarb. We write for the proper quantity of these se

EXAMPLE IV.—

For Mr. M. N.

Take, Of Mass of Mercury [quantity x],
 Of [powder of] Purified Aloes [quantity
 x],
 Of [powder of] Rhubarb [quantity x],
 Of Water, as much as may be required.

Mix, and divide into n pills.

Or, Mix : let it be made into a mass to be divided
 into n pills.

Label—"Two pills, at bedtime."

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Office-Hours : 8 to 9 A.M., 4 to 5 P.M.

August 28, 1894.

In this example, the expression "powder of" is interpolated in brackets before the official title of the drug, the point being this : *Purified aloes* is a stuff in lumps, and *rhubarb* is a root in bulk, and in order to embody such matters into a pill-mass they must first undergo pulverization. Such pulverized article the pharmacist will certainly take, whether the prescription order the form of powder or not, and thus both practices obtain among prescribers—some consider it enough for the physician simply to designate the drug he

state in the prescription that it is to be taken in powder. Another point is that in giving the *water* required, it is wholly unnecessary to write out "as much as may be required to bring the mass to a proper pilular consistence," for the pharmaceutical purpose of the water is obvious, and the compounder may therefore safely assume to divine the same. Indeed, many physicians would leave out all mention of the water, and it would be enough for the physician to state that he wants such and such drugs made into a pill, and what "excipients" pharmacy may require for that purpose being held to be a thing of course. The pharmacist is the best judge. A thing to be noted in this prescription is this: It will be required that the pills were to be made of equal parts of the three ingredients, and the example given is that of each of the three the

Hence our present prescription would, in actual practice, be begun thus :

Of Mass of Mercury,	} of each [quantity <i>x</i>].
Of [powder of] Purified Aloes,	
Of [powder of] Rhubarb,	

To translate now into Latin : “ mass ” is *massa*, and “ mercury ” is *hydrargyrum*, and our frequent experience of the endings hereby presented enables us to write genitives at once :

Massæ Hydrargyri.....

wherein *massæ* precedes *hydrargyri* because the phrase is the title of a preparation. In the next entry, “ powder ” is *pulvis* ; nouns in *-is*, by reference to table of endings, are of the third declension, and of very diverse genitives. We search carefully, and at last find catalogued “ *pulvis (pulveris)*.” *Pulveris* is, then, the genitive we seek, and, by the way, a safe guide to these troublesome third-declension genitives is afforded in very many cases by English words derived from the Latin, wherein the *root* of the word is displayed. Thus, in the present instance, the words *pulverize* and *pulverulent* furnish the key, showing at a glance the root *pulver-*, whence, of course, genitive *pulveris*. “ Of purified aloes ” will stand, in Latin order, the adjective following its noun—“ of aloes

a. Of this word *aloēs*, and *gender*, the latter because of adjective to be properly conform. Our table of endings shows *presc*-*e* to be certain of Greek origin and declension, and, therefore, of the first declension. But in inflection, in the singular, nouns are peculiar, and our declension, therefore, be referred to; this inflection in the genitive is found *aloēs*. Then "*purificatus*", which, in feminine form, is in the first declension, genitive therefore *purificatæ*. The whole title, then, becomes:

[*Pulveris*] *Aloēs Purificatæ*

Next, "*rhubarb*" is *rheum*, and the whole arrive at the rendering:

Massæ Hydrargyri,
 [Pulveris] Aloës Purificatæ,
 [Pulveris] Rheī, āā [quantity x].

"Of water, as much as may be required," we write, without ado,

Aquæ, quantum sufficiat,

or, abbreviated,

Aquæ, q. s.

Of the two forms of writing the pharmaceutical direction in the case, the first, "mix, and divide into n pills," is phrased, in Latin idiom, "mix, and divide into pills to the number of n ." The table of odd words gives *M.* for "mix," *et* for "and," *divide* for "divide," and *in* for "into," to be followed by noun in the *accusative*. *Pilula* is "pill," and, being of first declension, gives accusative plural, "pills," *pilulas*. "To the number of," is found among odd phrases as *numero*, which is again an oft-recurring word and so suffers abbreviation, being commonly written *no*. The direction, then, reads :

M., et divide in pilulas no. [n].

The other form, "Mix : let it be made into a mass to be divided in n pills," would be in Latin style, "Mix : let [it] be made [into] a mass, into pills to the number of n to be divided." Here,

quired to agree with the word for gender, number, and case. Hence declension, feminine, nominative singular require *dividendus* to become *dividenda*. The line will read :

M. : fiat massa in pilulas no. [n] d

Thus, in full, the two forms of pharmaceutical direction in question are obviously, such forms will be matters of substance, being used whenever the substance is a mixture of substances—prescribed is taken by the pharmacist, whether into pills (" powders "), capsulefuls, troches, sugar or other specialized forms. Hence—*abbreviation* is the fashion, and the will more commonly be written, in actual

in trochiscos, "into troches"; *in suppositoria*, "into suppositories," become, severally, *in chart.*, *in caps.*, *in trochisc.* or *in troch.*, and *in suppos.* Such abbreviations, however, are distinctly *not* to be recommended, for abbreviation leads to error "as the sparks fly upward."

A fifth example will illustrate yet another point. We want for Miss Q. R. a mild chalybeate, and we find provided by the Pharmacopœia certain appropriate pills, the so-called "pills of ferrous carbonate," where, furthermore, the standard weight of each pill is handy for the present indications of dosage, two of the pharmacopœial pills being just the proper amount for a single administration. Our prescription, then, in this case, is simply the form of an order to the pharmacist to dispense so many of these pills, and label the box "two pills, thrice daily." Thus:

EXAMPLE V.—

For Miss Q. R.

Take, Pills of Ferrous Carbonate to the number
of [n].

Label—"Two pills, thrice daily."

S. T., M.D.,

No. 5, Fifth street,

Office-Hours: 9 to 1,

August 29, 1894.

scription, stands in the *accusative* instead of the *genitive*. And the accusative plural of "pill," we have already found to be *pillule*. *Ferrous Carbonate* is, in the Latin of the Pharmacopœia, the translation of the simple *Carbonate* (meaning carbonate of iron) is *ferrum*, with genitive *ferri*, and "carbonate" we have already found to be *carbonas*, with genitive *carbonatis*. The prescription will read :

R. *Pilulas Ferri Carbonatis*, no. 2.
S.—"Two pills, thrice daily."

Suppose, next, that for a half-grown child we want this same chalybeate preparation now, for each dose, a little more than one, but less than two, of those of pharmacopœial weight. Nothing is simpler: we est

EXAMPLE VI.—

For Miss U. V.

Take, Of Pills of Ferrous Carbonate [quantity x].To be divided into [n] pills.

Label—"Two pills, thrice daily."

W. X., M.D.,
No. 6, Sixth Street.*Office-Hours*: 3 to 5 P.M.
August 29, 1894.

Here, evidently, "pills" with its adjective reverts to the genitive, and so the title of the drug appears:

R. *Pilularum Ferri Carbonatis* [quantity x].

"To be divided into [n] pills" is a phrase of now familiar structure, except that in this instance the *thing* "to be divided" is, grammatically, *quantity x*. The gender, number, and case, therefore, of *dividendus* must here conform to those elements of the word expressing denomination of quantity. Such word will, of course, be in the *accusative case*, but its gender and number will depend on circumstances. "Grains"

uenam. Scruple gives
ples" *scrupulos*; "drachm" and "d
"ounce" and "ounces," give, res
drachmam, *drachmas*, *unciam*, and *unci*
to conform, we shall thus have, several
adjective, *dividendum*, *dividendos*, *di*
dividendas. Our line will therefore read

In pilulas no. [n] dividenda, or -um, c
-am, or -as.

A few new points are exemplified in
instance. We want, for personal surg
solution of lunar caustic of a certain
The prescription, in such case, takes
form of ordering the proper proport
caustic and of *distilled* water (which a
be used for the purpose), and directing

EXAMPLE VII.—

For Self.

Take, Of Silver Nitrate [quantity x],
 Of Distilled Water [quantity y].
 Dissolve, and label : “ For external use.”

Y. Z., M.D.,
 No. 7, Seventh Street.

Office-Hours : 2 to 4 P.M.
 August 29, 1894.

Latinized, *argentum*, “ silver,” and *nitras*, “ nitrate,” give, obviously, the reading in the genitive :

R. Argenti Nitratis.....

“ Of distilled water ” is, in Latin order, “ of water distilled,” and is rendered

Aquæ Destillatæ.....

And “ dissolve and label ” appears as

Solve et S.

in which phrase observe that the familiar word, “ mix,” does not occur, for here is no *mixing* proper, but a simple *dissolving*.

So we might multiply examples, but enough have now been given to illustrate the commoner run of prescription-forms, and to show how easy of application are our few rules and tables of Latin words and usages.

passed by in our discussion and exemplified in prescription-technics, because, being an independent consideration, it is best studied

The subject of amounts, in prescription, divides into two parts : first, the consideration of the total amount of the mixture, and, secondly, the relative proportion of the ingredients. In regard to totals, the rule obtains, at the outset, *order more than the present prognosis see for*. To prescribe two dozen pills when only a dozen only prove to be needed, or a few drops of a mixture of which but a few teaspoonfuls are required—so the patient naturally reasons—shows carelessness or ignorance on the part of the prescriber. It is better, therefore, to order more than too much, letting the prescription be renewed if the first quantity prove

external use, as in the case of an ointment, a liniment, or a wash, must be based on general considerations of how and how often the thing is to be applied; but if the medicine is to be taken internally, the estimate is figured out from the *number of doses*, first, and *dimensions* of dose, secondly. We say to ourselves that x doses of the basis will probably do the work, and, then, that each dose shall, in the mixture as actually administered, occupy a dimension y . The total bulk, therefore, of the mixture is x times y dimension, or x times y weight, as the case may be. Having thus arrived at *about* the total required, for the *exact* amount we select a quantity representing a convenient round number in terms of the system of weight or measure by which we are prescribing: this for the reason that the arithmetic of apportioning the constituent parts of the mixture is thus rendered simpler than would be the case were an odd quantity taken.

In the case of fluids, furthermore, we select round numbers for the additional reason that medicine-vials are made of stated capacities corresponding to evenly expressed dimensions in apothecaries' and metric measure, respectively, and our prescribed mixture ought, both for the sake of convenience and of elegance, to measure just a bottleful.

nations is—disregarding the computation used scruple—essentially on a *duodecimal*. In using this system, therefore, we calculate by numbers bearing a simple relation to the number 12, viz., 2, 4, 6, 8, 12, 18, 24, 36, 48, 60, 72, 96, 120, 144, 180, 240, 480; and hence medicine—being in accord with apothecaries' measure, a system of several capacities *one, two, and four* fluid ounces, and *one, two, four, six, eight, and sixteen* drams, and *one, two, four, six, eight, and sixteen* ounces. In using the *metric system*, the most essential feature of which is the relation of its denominations, it is simpler and is infinitely easier, to deal with the expression is by those numbers since the number 100, viz., the several 10, 20, 25, 50, 75, 100, 200, 250, 500, and 1000. This point is often overlooked by novices.

Having settled upon the total, the apportioning of the constituents proceeds thus : The amount of the *basis* will be as many times the quantity intended for each dose as there are doses in the total mixture ; the amount of the *adjuvant* or *corrigent* will generally be determined by that of the basis, and the ingredients that go to form the *vehicle* will, then, fill the measure or weight of what remains of the total after allowing for the measure or weight already taken by basis and adjuvant, *except* in the case of prescribed weights of solids to be dissolved in volumes of fluid. In such case, we have to remember the peculiar physical fact that a solid dissolved in a fluid does not increase such fluid's bulk by the full measure of its own volume—in fact, increases it so little that, in the generally feeble solutions ordered in medical prescribing, it is customary to disregard altogether the volume of a dissolved solid, and to compute the volume of the solvent by the full capacity of the bottle intended to be filled.

Such are the principles for computing amounts in prescribing ; and now, as in the dealing with form and language, it is wise to illustrate by examples. We will, then, take the examples already presented, and proceed to fix the amounts of the ingredients by the apothecaries' and metric systems, severally.

a medicine intended for internal use. The first step toward determining total measure is to bethink us how many doses are needed. And by the outlook of this case we may assume the medication probably requires three doses daily for three or four days; then, we need to prescribe an aggregate somewhere between nine and twelve doses. As to *dimension* of dose, which comes next to be determined; inasmuch as the quantity of nine salt in each dose is to be small, the being for a stomachic effect only, a fluidounce of fluid will be a convenient measure the same. Furthermore, since the medication is a cent, and the indications for dosage are not very exact, it will, in this case, be perfectly allowable to allow the doses actually to be dispensed.

the mixture, and the apportioning of this among the several constituents thereof, will be affected by the scale of weight or measure adopted. We will proceed first by the apothecaries' system. An aggregate of somewhere between nine and twelve teaspoonfuls will suggest what round number of apothecaries' measure denominations? Instantly we say, *two fluidounces* average *twelve teaspoonfuls* of the rather large teaspoons of the present day (six teaspoons to the fluidounce); hence let our aggregate be two fluidounces, and let us figure on a basis of twelve teaspoonful doses. This point being settled, we are ready for the apportioning, and in doing this it will be found handiest to *write down first* the titles of *all* the constituents, and then, thinking of nothing else, compute and set down the amounts for each. The computation in this case, then, proceeds thus: Of the quinine salt we want *about* one grain for each dose; let us assume the dose, then, at that convenient round number, *one grain* exactly; then twelve one-grain doses give, at once, *twelve grains* for the total of the basis in the mixture. We accordingly set down:

R. *Quininæ Sulphatis* gr. xij.,

in which form observe that *gr.* and *not* "*grs.*" is the abbreviation of the Latin for "*grains*"; also

effect is here a chemical one, and the the acid is, therefore, determined by the the quinine. In a rough way—accurate for prescription-needs—it may be accurate to effect solution of a given quantity of sulphate, one-and-a-half times such of aromatic sulphuric acid will be required. At this ratio, it is also accurate enough to be estimated in terms of apothecaries. Hence, having *twelve* grains of quinine, we shall need *eighteen* of the analogous portion of volume of the acid—in short *minims*. We write, then :

Acidi Sulphurici Aromatici ℥ :

Coming now to the vehicle, we find the admixture of two ingredients, and to k

But here, on the principle already expounded, we entirely disregard the minute effect on volume exercised by the presence of the quinine salt in solution, and even the space occupied by the eighteen minims of acid is hardly worth considering. We practically estimate, then, that we have the total measure of two fluidounces to be filled by the vehicle, and, a fair proportion between our ingredients being one part of syrup to three of water, we apportion the two fluidounces thus :

Syrupi Amygdalæ f $\frac{2}{3}$ ss.

Aquæ Aurantii Florum f $\frac{2}{3}$ iss.

Here, in the matter of form, note the abbreviation *ss.* standing for *half*, derived from the Latin word *semis*, "half" ; and note in the expression for denomination that the letter *f* precedes the symbol " $\frac{2}{3}$," signifying that it is *fluid* ounce, a measure of capacity, and not *ounce*, a weight, that is signified. This same letter, *f*, which should thus properly always be placed before the symbol when expressing fluidrachms or fluidounces, is often omitted, on the idea of taking it for granted that in dealing with fluids the pharmacist will measure and not weigh. But accuracy, like honesty, is always the best policy, and this omission is, therefore, not to be recommended.

ounce vial for dispensing, there will be of eighteen minims of the mixture, by this measure of acid disregarded in a measure of the vehicle ; and there will be no error in the proportion of quinine in the mixture because the total is eighteen minims in the amount originally assumed. Both errors are trivial, but they can, if thought of, perfectly be avoided by the following procedure : Let us, of our last and least ingredient, the water, not order the *fixed one-and-a-half fluidounces*, which make eighteen minims too much, but direct it be " taken " *until the whole mixture shall be to the final full measure of two fluidounces* ; then, the pharmacist, having put into the vial the quinate, or into the two-ounce dispensing vial the three first named ingredients, simply

such method, the last entry will, then, appear thus :

Aquam Aurantii Florumad f ℥ ij.
Or, *Aquæ Aurantii Florum . . .q. s. ad f ℥ ij.*

Of these two forms, both of which mean precisely the same thing, the latter is perhaps the more advisable, since the introduction of the abbreviation *q. s.* calls more especial attention to the nature of the order. In both forms, the *amount*, be it observed, now appears as *two*, and not, as before, *one-and-a-half* fluidounces, although it is practically even less than one-and-a-half fluidounces that is taken ; but the word "two" is but part of the phrase, "up to the full measure of two," signified by the prefix of the preposition *ad*, as already sufficiently explained.

Next, to determine the amounts of the ingredients for the same mixture by the *metric* system : here we do *not* fly to our table of equivalents between apothecaries' and metric sums, and translate into grammes our twelve grains, eighteen minims, half ounce, etc. We *may*, of course, do this, and many would-be learners of metric prescribing follow such method, thinking it the proper course ; but such procedure, as already expounded, is to defeat the very advantage which the metric system offers—namely, the convenience of com-

figure solely in the terms and by the metric system. In the present case, turn to the starting-point, that we put where between nine and twelve teaspoonfuls of a mixture containing in each teaspoonful a small charge of quinine sulphate. What is the nearest round-numbered volume or denomination to the measure of between nine and twelve teaspoonfuls? Modern teaspoonfuls have the capacity of *five* cubic centimeters. Five cubic centimeters will be just the measure of twelve teaspoonfuls. We just as naturally now pitch on a decimal aggregate of *twelve* as before, when working a duodecimal system, selected a total of *twelve*. And this *twelve* ten doses is the measure, *fifty cubic centimeters* the measure of fifty grammes of water. In preparing the ingredients, we first, as before,

same mixture as before ! Before, you assumed the patient to need *one grain*, per dose, of quinine, and one grain is the equivalent of *six-and-a-half* centigrammes, instead of the *five* that you are now proposing !” Perfectly true, but the point is this : When we declare a sluggish stomach to be in such plight that a gentle bitter-tickling will probably benefit it, have we any means of gauging with scientific precision *exactly* the proper size of the titillation ? The initiated know well enough that we have not, so that when we solemnly order a *one-grain* tickle, they know that we do so, not because by any abstruse pathological observation we have discovered that one grain happens to be exactly the amount therapeutically indicated, but simply because that same one grain is *the nearest round-numbered quantity, in terms of apothecaries’ weight*, to the average quantity required in the run of cases assumed. The same principle of *convenience*, therefore, which makes a prescriber by the apothecaries’ system estimate a dose at exactly the round weight, *one grain*, leads him who uses the metric to assume the dose, in centigrammes, at the decimally handy figure *five*, and not *six*. Our total quantity of quinine sulphate is, therefore, for ten doses, ten times five centigrammes, *i.e.*, fifty centigrammes ($0.05 \text{ Gm.} \times 10 = 0.50 \text{ Gm.}$). Hence we write :

lowing the numeral. Observe also
occupying the unit place of the integer
in notation that should never be omitted,
thus we assure the reader of the presence of
the decimal point—that point of weight
—is just where it is *intended* to be. With
zero, that error of tenfold consequent
placement of the figures in relation to the
point, is easy to commit, and, committed,
only be detected by the reader through
edge of dosage.

Next, as to the amount of acid, the
previously shown, is to be half as much as
of the quinine. Hence fifty centigrams
quinine will require seventy-five of acid

Acidi Sulphurici Aromatici . . 0.

the proportion one to two or three, we shall very naturally assign *fifteen* cubic centimeters to the syrup and *thirty-five* to the water. But in order to get these volumes, we write—following custom in prescription—use of the metric system—for the proper *weights* in grammes, the pharmacist compounding by counterpoising his dispensing-vial on the balance and then weighing into it, so to speak, the several ingredients. What, then, is the weight of fifteen cubic centimeters of syrup? Fifteen cubic centimeters of *water* weigh fifteen grammes. But *syrup* is one of the few pharmaceutical bodies whose specific gravity is so different from that of water that we must take the same into account. And, by the table given awhile ago, we find that, pharmacopœial syrups being one-third again as heavy as water, we must order one-third additional in terms of weight to get a given volume. Wanting, then, fifteen units of volume, we order in units of weight fifteen plus one-third of fifteen—that is, *twenty*—and so set down :

Syrupi Amygdalæ 20.00 Gm.

As to the thirty-five cubic centimeters of orange-flower water, that is instantly disposed of : being an aqueous fluid, its weight is gramme for cubic centimeter, and so the thirty-five of measure is thirty-five of weight also. We order, then,

the apothecaries' system, by
for the orange-flower water to be added
the full measure of," etc., we can accom
end, metrically, with perfect ease, by d
from the amount of water to be ord
amount of acid already taken. Now, thi
convenient in using the apothecaries' syst
ply because of the want of relation, in tha
between denomination-values and ordina
metrical notation, making the calculation
expression of odd amounts so clumsy as
practicable. That is, to estimate and wri
quantity *one-and-a-half fluidounces les
minims* would be intolerably awkward
the metric system, the accord of the
standard decimal notation makes such
perfectly simple. We have merely, as
to five cents from thirty-fi

Our first example, then, as it would actually be written in practice, will be, in full, as follows :

EXAMPLE I.—

Not to be renewed.

For Mrs. A. B

[*Apothecaries' System* : 12 *teaspoonfuls* ; dose of basis, *gr. j.*]

R. Quininæ Sulphatis.....gr. xij.
 Acidi Sulphurici Aromatici. ... ℥ xvij.
 Syrupi Amygdalæ.....f ℥ ss.
 Aquæ Aurantii Florum.....f ℥ jss.
 (Or, Aquam Aurantii Florum.ad f ℥ ij.)
 (Or, Aquæ Aurantii Florum...q. s. ad f ℥ ij.)

[*Metric System* : 10 *teaspoonfuls* ; dose of basis, 0.05 Gm.]

	Gm.
R. Quininæ Sulphatis.....	0|50
Acidi Sulphurici Aromatici...	0|75
Syrupi Amygdalæ	20|00
Aquæ Aurantii Florum.....	35|00, or, 34|25
M S.—“Teaspoonful thrice daily before eating.”	

C. D., M.D.,
No. 1, First Street.

Office-Hours : 8 to 10 A.M., 5 to 6 P.M.
 August 25, 1894.

follows: This mixture, being
in but single dose, and the total
directly, then, on the dimension of
dose. Now, Mr. E. F. is a big, ha
man, and will probably take a full me
oil; so we will make our mixture to
a full dose of castor-oil, although,
sake, we will order only one-half to
once, reserving the other half for a p
tition. Now, a full dose for a hearty
this oil, from a tablespoonful to a ta
and a half, the dosage having consid
To emulsify, we shall need, of eg
one-half the amount of the oil, and,
further dilution, shall want of th
tween one and two measures of
In all the amounts, from the natu
there is a good deal of latitude.

yolk of egg will be half a fluidounce, which happens to be just about the measure of an average single yolk. Having thus a fluidounce and a half, now if we make, of the whole, a four-ounce mixture, we shall have an exact bottleful, as bottles are made, and the two-and-a-half fluidounces to be occupied by the diluent will be within the range of advisable proportion of the same. So we order of the essential ingredients,

R. *Olei Ricini*..... f $\frac{2}{3}$ j.
Vitellum Ovi unius.

Of the two-and-a-half fluidounces to be occupied by the diluent, we will assign the odd half to the syrup and the two to the water, taking but a small proportion of syrup, because of the viscosity already present in the oil-emulsion. So we write for the diluent,

Syrupi Aurantii. f $\frac{2}{3}$ ss.
Aquæ Menthæ Viridis...... f $\frac{2}{3}$ ij.

Or, if we are pursued by a demon of exactitude, remembering that the yolk of egg may not turn out precisely a half-fluidounce, we save ourselves as to total bulk by writing the last entry,

Aquæ Menthæ Viridis. . . . q. s. ad f $\frac{2}{3}$ iv.

Metrically, our range of quantity for the oil, to

of the average modern tablespoon) of one egg in its entirety being had will allow the same, although so than half the measure of oil. Egg yolk at fifteen cubic centimeters, with the oil, gives a total bulk, for of forty cubic centimeters. And, a amount of diluent, the quantity six centimeters suggests itself, a quantity bring the whole to the even measure of hundred cubic centimeters; and then sixty we will apportion by giving syrup and forty-five to the water-ment that gives us a proportion amounts, respectively, of syrup and is in the neighborhood of that prescription by apothecaries' mea-

needed allowance can be made without the slightest difficulty: twenty-five less one-tenth is twenty-five less two and a half, or twenty-two and a half. We order, therefore, for the emulsion,

R. *Olei Ricini* 22.50 Gm.
Vitellum Ovi unius.

As regards the diluent, the fifteen cubic centimeters of syrup will, as in the other example, weigh twenty grammes, and the forty-five of water, forty-five. The completed example then reads thus:

EXAMPLE II.—

For Mr. E. F.

[*Apothecaries' System : four-ounce mixture.*]

R. *Olei Ricini*..... f $\frac{3}{4}$ j.
Vitellum Ovi unius.
 Tere bene simul ; dein adde
 Syrupi Aurantii f $\frac{3}{4}$ ss.
 Aquæ Menthæ Viridis..... f $\frac{3}{4}$ ij.
 (Or, *Aquæ Menthæ Viridis*..q. s. ad f $\frac{3}{4}$ iv.)

Vitellum Ovi unius.

Tere bene simul ; dein adde

Syrupi Aurantii

Aquæ Menthæ Viridis

M. Fiat emulsum.

S.—“ One-half at a dose.”

G. H., M.D

No. 2, Second S

Office-Hours : 11 to 2.

August 26, 1894.

The third of our examples was for lemon-juice flavored citric acid, to be dissolved in water of the strength of ordinary lemon-juice, and neutralized with potassium carbonate. The data for computing amounts are that about *five or six doses* ; these of *tablets*

tem we have *four fluidounces* as the average measure of six tablespoonfuls, and so we fix the first item, the totality of the prescription, at that figure. The next step is to find six per cent. of four ounces, which will be the amount of acid required—a clumsy problem in the apothecaries' system, but which we solve thus: *one grain* is the *one-four-hundred-and-eightieth* of one ounce; suppose it were the *one-five-hundredth* and it would be just the *one-fifth of one per cent.* of an ounce. Then *five grains* would be *one per cent.* of an ounce, and six times five, or *thirty*, would be *six per cent.* Then, further, if *thirty grains* be *six per cent.* of *one ounce*, *four times thirty*—one hundred and twenty—is *six per cent.* of *four ounces*. Such number, then, being the conveniently rounded amount of *two drachms*, we adopt as being near enough to what is demanded. The same arithmetic also fixes the one-tenth of one per cent. of oil of lemon at *two minims* (one per cent. of four fluidounces is, roughly, *twenty minims*, one-tenth of which is *two*).

Turn now from this roundabout process of calculation to the decimal convenience of the metric system. Needing five or six tablespoonfuls, we instantly select a total measure of one hundred cubic centimeters, which averages the capacity of five tablespoonfuls; then, for our percentages,

EXAMPLE III.

For Miss I. J.

[*Apothecaries' System : six tablespoonfuls.*

R. Acidi Citrici..... ʒ i

Olei Limonis ℥ i

Tere simul ; dein adde

Aquæ..... f ʒ

Solve, et adde gradatim

Potassii Carbonatis..q. s. ad saturat

[*Metric System : five tablespoonfuls.*

R. Acidi Citrici.....

Olei Limonis.....

Tere simul ; dein adde

Aquæ.....

adde gradatim

In the fourth example—the pills of blue mass, aloes, and rhubarb—the amounts are readily fixed. We want enough pills to last ten days or thereabouts; and the nightly allowance of each ingredient is about—apothecaries' system—two grains. A daily dose, then, of *two* pills, each containing *one* grain of the several constituents, will answer the purpose, and, plainly, twenty such half-strength pills will be needed. We must, then, order a mass composed of twenty grains each of the three constituents, and direct this to be divided into twenty pills. Metrically, we would rate the daily allowance of the several constituents at *ten* centigrammes, and the amount necessary for ten days would then be, of each, ten times ten centigrammes, or *one gramme*. The prescription would then read :

EXAMPLE IV.—

For Miss M. N.

[*Apothecaries' System: 20 pills @ gr. j. of each ingredient.*]

R. Massæ Hydrargyri,
 [Pulveris] Aloës Purificatæ,
 [Pulveris] Rhei..... āā ʒj.
 Aquæ..... q. s.

[Pulveris] Aloës Purificatæ,
[Pulveris] Rhei.....ãã 1.
Aquæ.....q. s.

M., et in pilulas no. xx. divide.

Or, M.: Fiat massa in pilulas no. xx.

S.—“Two nightly.”

O. P.

No. 4, Fo

Office-Hours: 8 to 9 A.M., 4 to 5 P.M.
August 28, 1894.

In example number five the amount
the number of pills, of a size and
already determined by the Pharmacist
the patient is likely to require for
need. Assuming by the outlook of

EXAMPLE V.—

For Miss Q. R.

℞. Pilulas Ferri Carbonatis.... .no. lx.

S.—“Two pills, thrice daily.”

S. T., M.D.,

No. 5, Fifth Street.

Office-Hours: 9 to 1.

August 29, 1894.

In the next example we want everything the same as in the last, except that the dose must be somewhat less—somewhere between two-thirds and three-fourths of the foregoing amount. We can accomplish the result easiest by giving fewer pills a day, but we can also, if we choose, preserve our method of giving two pills thrice daily by simply having each pill of but from two-thirds to three-fourths the pharmacopœial weight. For it so happens that this particular mixture the pharmacist, for pharmaceutical reasons, will probably compound afresh for each order, so that, having the pill-mass to make, it is just as easy for him to divide it into small pills as into large. We turn, then, to our Pharmacopœia, and find that each pharmacopœial pill weighs, in the metric system which alone is standard in the present revision of the Pharmacopœia, 0.30 gramme. For our sixty pills of standard weight the phar-

cally, 12.00 grammes, each pill at 0.20 instead of the original 0.30 g estimating by apothecaries' weight, calculate backward, so to speak, from metric quantities of the Pharmacopoeia. 12 grammes is, roughly, three drachms, divided into sixty pills, three grains to each pill. We present

EXAMPLE VI.—

For Miss U. V.

[*Apothecaries' System* : 60 pills

R. Pilularum Ferri Carbonatis.
In pilulas no. lx, dividendas.

[*Metric System* : 60 pills @ 0.20 g

R. Pilularum Ferri Carbonatis

the seventh example we are ordering a solution of silver nitrate of a certain strength for external use. Now, in medicines which, like silver nitrate, are employed in very different strengths in solution, we commonly rate the strengths, in the apothecaries' system, by the number of grains to fluidounce, speaking, by ellipsis, of a "five-grain solution," "ten-grain solution," etc.; while in the metric measure we naturally speak of strengths in percentages, as a "one-per-cent. solution," "two-per-cent. solution," etc. In our present instance we will assume that we want *about* a fluidounce or so of a solution which shall be of *about* "twenty grains" strength. The amounts, then, appear in the stating. Thinking metrically, we might propose, probably, twenty-five cubic centimeters of a four-per-cent. solution, and the amount of the caustic to make such strength appears on the instant: for were the volume one hundred cubic centimeters, *four* grammes would, of course, be a four-per-cent. solution; but the volume stated being but one-fourth this measure, one-fourth of four grammes becomes the weight of silver salt to be taken. The prescription is, therefore:

R. Argenti Nitratis.....
Aquæ Destillatæ.....

[*Metric System : 4-per-cent. s*

R. Argenti Nitratis
Aquæ Destillatæ.....

Solve et S.—“For external use.”

Y.

No. 7, S

Office-Hours : 2 to 4 P.M.

August 29, 1894.

is is given in a *fluid mixture* under the common conditions that the total shall be an *exact* *bottleful*, as bottles are made, and that the dose shall be measured by the conventional spoonful. Under these conditions, knowing *about* how much is we want for a dose, and *about* how many doses we are likely to require, what ready method is there for finding what round aggregate of basis what even bottleful of mixture will give, to the what number of spoonfuls, the right amount of dose? To illustrate: We want to give, in fluid mixture, ten or a dozen four- or five-grain doses of some stuff: then on how big a bottleful shall

base our prescription; how big a spoonful shall hold our dose; and what bottleful and what spoonful will give a convenient round total of doses for a four- or five-grain charge per spoon-

To solve the problem, the first point to look at is the size of spoonful to take the dose of

If the basis is to be in *solution*, of course the factor of degree of solubility has a prime bearing; but assuming this not to stand in the way, then the next consideration is that, in *administration*, the strength of solution had better be limited to (round numbers, apothecaries' *ten grains*, or (round numbers, metric *fifty centigrammes* to the *teaspoonful*, and, *tablespoonful*, four times these weights, viz.,

spoonful of vehicle, nor more than
or *one gramme*, in a *tablespoonful*
figures, however, refer to the con
dose as *actually administered*, and
limits of strength in the prescribin
the dose is to be taken, without d
from the bottle. But it obviously r
venience, if the solubility of the ba
order the mixture much more conc
the foregoing limits, with the unde
it is to be properly diluted for the
posing, thus, of the first point, the
ing the data of *dose of basis*, *numbe*
size of spoonful, to get that combina
of mixture and of basis which v
fulfil the requirements of the da
hand, and offer round numbers f
thing on the other. In

TABLE SHOWING NUMBER OF AVERAGE SPOONFULS TO ROUND METRIC VOLUMES.

Teaspoonfuls.	Tablespoonfuls.	Cubic centimeters.
5	..	25
10	..	50
20	5	100
40	10	200
50	..	250
60	15	300
80	20	400
100	25	500

In the table, only those equivalents are given which are likely to be calculated from in actual practice. To illustrate the application, let us assume that we want about a dozen or so doses of somewhere between eight and twelve centigrammes of a thing to be given in fluid mixture. From the smallness of the dose we naturally select a teaspoonful rather than a tablespoonful for the measure of vehicle to hold each of the same. Then referring to the table, and seeing that a fifty cubic centimeter measure offers an aggregate of ten teaspoonfuls, we at once select such total for our mixture, and calculate the total of basis on the scheme of ten doses. And in such calculation appears the enormous

conveniences in calculation or expression. We describe our doses *exactly* as per the therapeutic indication. Thus, in the present case we are ordering an aggregate of ten doses, the estimated dose be any of these seven—*eight, or nine, or ten, or eleven, or twelve grammes*—and the aggregate is equally exact in calculation and expression: we have but to divide by ten, and set down in ordinary notation, respectively, thus: 0.80, 0.90, 1.00, 1.10, 1.20 Gm.

If, however, we use the apothecary's system, we are practically bound by its clumsy way that odd amounts are so inconvenient in expression as to be impracticable for prescription. We have in this case, then, to learn, by trial and error, certain set combinations of aggregates

which will enable us to figure our doses in

In the table on page 178, as in the foregoing, combinations that yield awkward amounts are omitted mention, and the calculation is on the basis that obtains in the case of modern spoons, of *six* teaspoonfuls and *one-and-a-half* tablespoonfuls to the fluidounce. But if it be known that an old-fashioned small-sized spoon is to be used, or if the patient use a graduated measuring-glass, then the calculation should be on the scheme of *eight* teaspoonfuls and *two* tablespoonfuls, respectively, to the fluidounce—should, that is, rate the teaspoonful as a fluidrachm and the tablespoonful as half a fluidounce. In such case the table on page 179 applies instead of the preceding.

These tables are offered simply for reference until the beginner, by practice, comes to remember, as he soon does, the most handy of the combinations.

So, having studied the how to compose, how to write, and how to compute amounts for a prescription, it remains but to note a something still to be done, even after the prescription is ready for delivery. And that is, before such delivery, critically to *review* the paper—scanning deliberately drug-names, amounts, and doses. Found early, an error is a matter of the stroke of a pen; found late, perhaps of a coffin and a coroner's jury!

Teaspoonfuls.	Fluidounces.	Total of basis, in or the teaspoonful, s		
		Five grains.	Ten grains.	Fif gr
3	$\frac{1}{2}$	gr. xv.	℥ ss.	
6	1	℥ ss.	℥ j.	
12	2	℥ j.	℥ ij.	
24	4	℥ ij.	℥ ss.	
36	6	℥ iij.	℥ vj.	
48	8	℥ ss.	℥ j.	
72	12	℥ vj.	℥ iss.	

Spoonfuls.	Fluidounces.	Total of basis, in o the tablespoonfu		
		Five	Ten	

TABLE SHOWING THE NUMBER OF FLUIDRACHMS AND HALF FLUIDOUNCES TO ROUND APOTHECARIES' VOLUMES, AND THE AMOUNT OF BASIS TO YIELD TO THE FLUIDRACHM AND HALF FLUIDOUNCE DOSES, SEVERALLY, OF 5, 10, 15, 20 GRAINS.

Fluidrachms.	Fluidounces.	Total of basis, in order to give to the fluidrachm, severally—			
		Five grains.	Ten grains.	Fifteen grains.	Twenty grains.
4	$\frac{1}{2}$	℥ j.	℥ ij.	℥ j.	℥ iv.
8	1	℥ ij.	℥ iv.	℥ ij.	℥ viij.
16	2	℥ iv.	℥ viij.	℥ ss.	℥ xvj.
32	4	℥ viij.	℥ xvj.	℥ j.	...
48	6	℥ ss.	℥ j.	℥ iss.	℥ ij.
64	8	℥ xvj.	...	℥ ij.	...
96	12	℥ j.	℥ ij.	℥ iij.	℥ iv.

Half Fluid-ounces.	Fluidounces	Total of basis, in order to give to the half fluidounce, severally—			
		Five grains.	Ten grains.	Fifteen grains	Twenty grains.
2	1	gr. x	℥ j.	℥ ss.	℥ ij.
4	2	℥ j.	℥ ij.	℥ j.	℥ iv.
8	4	℥ ij.	℥ iv.	℥ ij.	℥ viij.
12	6	℥ j.	℥ ij.	℥ iij.	℥ ss.
16	8	℥ iv.	℥ viij.	℥ ss.	℥ xvj.
24	12	℥ ij.	℥ ss.	℥ vj.	℥ j.

PART II.

TECHNOLOGY OF MEDICINE

CHAPTER I.

MODES OF MEDICATING.

THE possible effects of medication are of two kinds : first, the effects upon the tissue with which the medicine comes in contact, produced by virtue of such contact ; and, secondly, the *consequences* of such effects, appearing even in distant parts, either as new phenomena, or as consequences of changes in the system.

The subject naturally divides itself into two parts, viz., how to touch with a medicine the *surfaces* of the body, on the one hand, and how, on the other hand, the *underlying tissues*.

Of the surfaces, the *skin* is so obviously accessible to any mode of medication that, in its case, but few technical points present for discussion. Of these, the first to note is that the skin, because of its comparative insensitiveness and resistance to transfusion, can safely bear, even of poisonous things, far stronger and more extensive applications than can the mucous membranes. Yet, as will be seen in detail further on, the skin *can* absorb, so as to charge the blood with the absorbed thing to a dangerous or even a fatal degree. Powerful medicines, and especially those that combine the qualities of *potency*, *volatility*, and *high diffusion-power*, as, for instance, *carbolic acid*, must therefore not be applied to the skin too strong or too extensively. Secondly, it must be remembered that the skin is a true organ, having physiological functions; and that applications of a kind and extent to interfere seriously with the performance of such functions are, for that reason, inadmissible. The persistent covering of nearly the whole of the skin with an impervious layer of ointment—even if the ointment be in itself innocent—is therefore an unadvisable proceeding.

and epithelium, are, thus, important to precede a course of skin medication. when hairy parts are to be medicated should first be cut short or the part shaved. fifthly, it is to be remembered that, of the vehicles into which medicines are put for application to the skin, fatty matters penetrate cracks and crevices better than aqueous fluids, and, of the fatty matters, *oleic acid* and *oleates* dissolved in it, the acid are by far the most penetrating.

The other exposed surfaces of the body, besides the skin are, of course, the *mucous* surfaces. Concerning these in our present consideration, we will note at the outset two important points. The first is the matter of the very different *disposability* of the different mucous surfaces, such as those of the eye and mouth.

normally suffer touch from without, while to others foreign touch is obnoxious. The former must necessarily be insensitive, while the latter, finding a safeguard in sensitiveness, may be exquisitely tender. And, of course, the present interest in these facts is the plain indication that, in medicating, applications to mucous membranes must be proportioned in strength to the natural sensibility of the part touched. The most sensitive mucous surfaces are those, severally, of the *cornea*, the *upper* portion of the *nasal cavity*, and the *larynx*; next come, in order, the general surface of the *conjunctiva*, the *air passages* beyond the larynx, the *middle ear*, the lower portion of the *nasal cavity*, and the *urethra*; while least sensitive are the mucous coverings of the *alimentary canal* and of the *female generative organs*.

Of the means of reaching these various parts, we note that the *conjunctiva* is immediately accessible; the only technical point to make being that, to secure thorough application to the retro-tarsal fold, the upper lid must be fully everted, while the patient is directed to look strongly downward. Otherwise the very part that in conjunctival diseases most needs medicinal touch will escape the application altogether.

The mucous membrane of the *nasal cavity* is very difficult of thorough access, and the cavities

—or powders may be blown up the
a rubber bag with a nozzle, or fl
injected either from before or behind
of such injections, now happily pret
ly appreciated by practitioners, is th
the injection may find its way *via* th
tube into the *middle-ear*, a cavity w
membrane will almost certainly res
trusion by inflaming. The *nasal do*
years ago is now, therefore, very g
demned, and even the *posterior nasal*
under the ban with many. This lat
is certainly the least likely to offe
injection is to be practised at all. T
nasal syringe is simply a syringe v
long enough to reach through the n
fauces, and with the end of such noz

made of hard rubber, the nozzle may gently be warmed, and then the proper curve easily given to it. For *self-use* it is also a convenience to bend body and nozzle, where they join, to a right angle. The body then hangs vertical during application, an easier position for the self-injector.

The *Eustachian tube* is reached by the Eustachian catheter, an instrument whose application belongs to the domain of surgery.

The *mouth* is, of course, directly accessible, and the *palate* and *pharyngeal cavity* practically so. To the posterior portions of the oral cavity the method of *gargling* applies, but the same is a very ineffectual procedure, the pharyngeal cavity proper being scarcely touched at all by the fluid. Applications of *spray* are here peculiarly happy.

The *larynx* can be reached by proper probang, guided by a view in the laryngoscope-mirror, but such special and delicate manipulation, of course, must be taught to the individual clinically. Gaseous medicines or fluids in fine spray can be applied by inhalation—remembering that, of course, such only are allowable for this application as are *innocent* and *unirritating*.

The *air-passages beyond the larynx* are, obviously, locally accessible only through inhalation. Gaseous medicines of the kinds just indicated can thus be applied, but there are few of such kinds

beyond the larger bronchi.

The *bladder* can be reached by injection into the *urethra*; and the *urethra* itself by the insertion of a medicated plug of butter (urethral suppository) "bougie" or by the passing of a sound smeared with the medicine. The instruments and manipulations required are, again, as in the case of the *larynx*, too special to attempt to treat generally. The urinary passages can also be treated with certain volatile oils and resins, such as *sassafras* and *cubeb*, be reached by impregnating the *urine* with the medicine through the *urine* by the way of *swallowing* the drug. In this way the drug is absorbed into the blood, and is excreted in the *urine*, comes thus in direct contact with the urinary mucous membrane.

The *urine* can easily be examined

flexible rubber tube ending in the nozzle, and armed with a stopcock of simple device. The bag is filled with the injection, then hung against the wall on a nail three or four feet above the level of a seat. The nozzle is inserted (the patient, of course, sitting over an ample receiving-vessel), the stopcock is turned, and gravity then determines a steady flow of the injection, the *force* thereof being the greater the higher the bag is hung. During a vaginal injection, the nozzle should be rotated from side to side, and withdrawn and pushed up from time to time, so as to secure irrigation of all parts. More certain for this end, although more inconvenient, is the plan of having the patient on her knees and elbows during the injection. In that position the walls of the vagina tend to fall asunder, and the injection thus more surely reaches every point of surface. The vagina can also be reached by vaginal suppositories, or by medicated pessaries, or by instrumental appliances under exposure by a speculum.

The *uterus* can be injected, but at great risk of having the injection escape into the peritoneal cavity through the Fallopian tubes, with possible mischievous or disastrous consequences. Otherwise, medicinal applications to this cavity are made by special instrumental means.

the stomach. By an arrangement of
can be pumped *into* the organ, as w
gan's previous contents pumped *out*.
ing the alimentary tract, it must be
that here is one of nature's greedily a
faces, and that the majority of things
canal for local effect cannot be pre
also finding their way into the b
medicines, however, either because o
or of low diffusion power, are so slo
fect of absorption that quite a valuab
can be produced by them in the bo
the system at large being affected.
amples in point are the salts of bismu
purges. We must also see to it that
ness to medicate this tract we do
with its functions, as by spoiling ap
ing nausea or diarrhoea, etc.

washings, the bowel is given a short rest, and then the medicated enema is to be *slowly* injected. And such enema should be of small bulk—not over two fluidounces—and blood-warm, so as not to excite the bowel to its expulsion. On withdrawing the nozzle, the fingers or a napkin should be pressed against the anus for a few seconds, and the patient, if old enough to understand, cautioned to resist any inclination to strain. In practising any rectal injection, the points should be observed to have the nozzle *warm* and *well greased*, and to pass it, after it is once engaged within the sphincter, *upward* and *backward*, following the concavity of the sacrum. The passage should be slow, and, in the case of a crying child, the pressure should be exerted only during the *inspirations*, when the abdominal walls are relaxed.

In thus running over the special means of medicating the mucous membranes, a *fine spray* of fluid has several times been mentioned. This condition of a fluid medicine is a valuably convenient one, since it allows fluids to pass without irritation into the air-passages, and, even to exposed parts, enables us to apply liquids thoroughly and evenly without *drip* and *slop*. Fine spray is obtained by appliances based on the following simple principle: let a rather narrow tube, with

through which from behind a sea
or steam can be driven. By the
caused by such blast, the fluid from
sucked up the first tube and appo
orifice thereof. But no sooner do
show itself than it is, at once, lit
atoms by this same blast through t
—is, in short, dispersed in a cloud
fine spray. The contrivances op
principle are called *spray-produce*
and are modelled of different shap
ent special applications. The bla
obtained by hand-pressure on a
sphere connected with the appara
tube bearing a second rubber spl
its course. This mid-sphere acts
determining a steady blast durin
tent action of the terminal sphere

apparatuses for such end having been devised under the name of *steam-atomizers*.

To apply medicines to parts *beneath* the surface, meaning all parts of the body save skin and mucous membranes, we can for a few special purposes inject into muscles or into serous cavities, but in the enormous majority of instances we medicate all underlying tissues by putting the medicine, by some means, into the *blood*, thus, as it were, shipping it to its distant destination through that universal avenue of communication. But in so doing arises at once a consideration which does not obtain in surface-medication. It is that we cannot here, as we can there, restrict the contact of the medicine to the part required to be medicated; for the stuff, being dissolved in the general mass of the blood, must, perforce, go wherever the blood goes; we cannot confine its tour in the vascular system to any one artery going to a particular part. To medicate brain, or spinal cord, or kidneys, or a single neuralgic nerve even, there is no help for it, but we must bathe the whole blood-supplied organism with medicated blood, and thus, perhaps, secure our therapeutic result over one part at the expense of considerable annoying derangement of others. This is unfortunate, of course, but it is unavoidable, and all we can do is to give prefer-

NOW, to get a medicine
a variety of ways. The easiest
therefore commonest method is
course in getting *nourishment*
namely, to let the medicine be
be absorbed through the vein
the general circulation. Not o
est way, but it has also the s
others that substances in all co
and of obstinate insolubilities ca
as it were, upon the organism,
exception if the complex chem
viæ will not extract the virtues
ble form and duly deliver t
blood-vessels. Yet still, for
stomach may be objectionable
unavailable as the avenue thro
the vascular system. This sa

may be in such morbid state from disease that even normally wholly harmless things, like ordinary foods, upset it and are not to be borne. Or, because of corrosive poisoning or of stricture of the œsophagus, the organ may be absolutely disqualified for use ; or it may practically be so because its absorbing capacity is in abeyance from inflammation of its mucous membrane, from narcotic poisoning, or from general collapse of all vital powers when life is at low ebb from serious disease. Thus when an individual is in profound coma from opium-poisoning or is in the collapse of cholera, absorption by the stomach stops, and it is worse than useless to thrust drugs into the paralyzed organ with a view to their absorption. Or, though the stomach may bear a drug fairly well, and its functional activity be in good state, yet it must be remembered that the rate and thoroughness of absorption by this organ are necessarily subject to variation. The potent gastric juices may chemically attack the medicine and thus defeat our purpose, or the mere mechanical obstacle arising from the presence of a large mass of food, with which the drug necessarily becomes mixed upon swallowing, may so delay full absorption as to be of serious cost. Hence, when a therapeutic call is urgent and an effect of dosage both *prompt* and *full* is imperative, we dare not

the stomach is the rectum, by enema or suppository is not apart from the obvious inconvenience it may be, indelicacy, of using this method has its disadvantage. The power of the rectum is not so great as the stomach, and, more particularly, the complex digestive fluids of the stomach or small intestines, as soluble drugs and reduce them to a state of absorption. Hence to introduce drugs into the blood by means of the rectum, in the first place, administer them as we would give by the stomach, in the second, that the substance is either dissolved or is in condition of a simple aqueous solution.

Besides the rectum, the lungs

gas, *ammonia*, and certain volatile ethereal fluids, such as *amyl nitrite*, *ether*, and *chloroform*, are pretty much the only things given by this method.

Next, we can avail ourselves of the *skin* for purposes of constitutional medication, and that, too, in a variety of ways. Certain easily diffusible substances, in solution, will be absorbed through the sound skin if only laid thereon, by wetted cloths; but such means is so crude, and dosage so uncertain, that the procedure is nowadays rarely resorted to.

A method of determining absorption through the skin that is, however, much used, and with great advantage with the particular drug *mercury*, is to rub into the skin a fatty preparation carrying the medicament, when, largely by mechanical forcing, the particles find their way into the texture of the skin, and thence, after undergoing chemical conversion into a soluble compound, into the blood. Other medicines, also, can be introduced in this way, such as, for instance, the alkaloids; but since in the majority of cases this class of substances can be given better by hypodermatic injection, this method of *inunction*, as it is called, is, in the case of alkaloids, rarely employed. Then—again practically confined to preparations of mercury—the drug can be sub-

limed and the vapor allowed to condense upon skin, when absorption will ensue.

Next, passing from natural ways, we can put medicines into the blood by *artificial methods* through surgical procedures. We can, in the first place, by appropriate apparatus, pierce a vein with the nozzle of a syringe, and thus inject directly into the vascular canals. Such method is occasionally used by practitioners of great hardihood, even in the case of powerful drugs, but is to be condemned for its obvious dangers, and, by the bulk of the profession, is resorted to only as a means of introducing into the blood bland nutriments, such as milk or blood, or a simple saline solution—all as a means of keeping the heart going when a patient is in desperate straits. Another method, less severe, is to raise a small blister upon the skin somewhere, remove the separated epidermis, and, upon the raw surface beneath, lay the medicine; which, in this case, must, for obvious reasons, be one which is, at the same time, efficient in small dose, readily soluble, and not unduly irritant. This method, the *endermotic*, has, however, been entirely superseded by the far better, though physiologically similar, *method by subcutaneous or hypodermatic* (barbarously miscalled *hypodermic*) injection. The procedure in this case is simply to pierce the skin

with a fine and sharp nozzle of a small syringe, and then inject into the loose subcutaneous connective tissue the medicine—of course in solution. From the purely physiological point of view this is the best method of all. Absorption is rapid, thorough, and almost invariably certain, under all conditions and circumstances of the patient's morbid state; derangement of digestion is reduced to a minimum, and, with some drugs, certainly, the therapeutic effect is more intense, or more persistent, or even, as in the case of morphine given to combat neuralgic pains, more *radical*, than where the same drug is administered by other methods. Because of these great advantages the hypodermatic syringe is as universal a tool with the practitioners of to-day as was the lancet with our fathers, but yet the method has its restrictions. Not everything can be given by subcutaneous injection. Obviously the medicament must not be severely irritant, else great pain, and even subsequent inflammation and abscess at the seat of puncture, will result. Again, if a solid, the drug must be soluble in reasonably bland fluids, such as water, weak alcohol and water, glycerin and water, or solutions of mild salts; and, lastly, it must be a thing whose *dose* is small enough for the bulk of the injected fluid not to exceed two cubic centimeters (thirty

sick, nervous, and exhausted. The idea of being stabbed, though, of course, is terrifying. Then, even trained nurses are in attendance, and the patient must himself administer the dose. This is a very obvious great inconvenience to the patient both, and to the patient's pocket, and to the ill-to-be-afforded expense. With the use of the hypodermatic method, namely, morphia, there is often the serious danger of the "opium habit" may thus unconsciously be formed, and, if so, it will be the part of the patient to be enslaved by a vice that will work more cruelly hard from within than any other. The dainty poniard of the "opium habit" is then, not always the boon that it is sometimes supposed to be. It is a temptation to the sufferers of to-day—to judge

ship be good—of hard rubber. There must, next, be a *graduation* somewhere to tell the amount injected. This, in the case of glass cylinders, may be on the cylinder itself, but, in the case of instruments made of opaque material, must necessarily be on the piston. In the latter case there is commonly a small screw-collar on the piston, which, by setting at the proper mark, stops the piston from going beyond a certain distance, and so limits the amount of injection possible to deliver. On purchasing a syringe, the graduation should be tested for accuracy before trusting to its possible false showings. The *needle* should be clean, sharp, and free from rust—conditions best maintained by having the needle of gold, with, of course, a point of harder metal. The point should be a plane bevel, and the whole needle should be *fine* rather than coarse.

Having, thus, a good syringe, have, next, a *good solution*. No *dirt*, no *decomposition*, and no *free acid* must find place therein, and we must be *certain of the strength*, which, by the way, must not be too great. Water is the best vehicle for the injection, and things soluble in that fluid are therefore the favorites for administration by the hypodermatic method. The solution is better made fresh, and any clean water fresh from a tap is better than stale and, therefore, almost certainly

mouldy distilled water. If solutions be kept, assuming them to be salts of alkaloids, they must be charged with some preservative, such as hydrate of chloral, carbolic acid, salicylic acid, etc. One per cent. addition of any of these bodies proves antiseptic, but the same are all more or less irritant, and hence fresh solutions are preferable. For convenience in making fresh solutions, manufacturers offer tablets charged with fixed quantities of the things commonly used for hypodermatic injection. These tablets are simply dissolved in a few drops of water on the occasion of the injecting. Such tablets are made of *gelatin* or of *sodium sulphate*, the salt in the latter instance being given form and cohesion by powerful pressure. These medicated tablets, if of reliable make, are exceedingly convenient, the compressed tablets of the sodic salt especially so, provided they are fresh enough to dissolve readily.

Being ready with a good syringe and a good solution, we fill the one with a sufficiency of the other, then hold the syringe vertical, needle-end up, and gently push upon the piston until fluid appears at the needle orifice. Thus the bubble of air, which it is practically impossible to prevent from having place within the cylinder, is charged, and we are now certain that the syringe is just as full of solution as it purports to

next *fix the dose* beyond possibility of misadventure by observing where the piston stands in relation to the graduation upon its shank, and by then running down the screw-collar so far that on driving the piston home as far as the collar will allow it to go we shall inject just the desired quantity. Then a fold of skin is pinched up with the fingers of the left hand, and into the triangular slope trending downward from between the fingers the needle is quickly plunged, in direction carefully parallel to the surface of the limb beneath. After having been pushed in to a depth of from half to three-fourths of an inch, it should be gently withdrawn a trifle, and worked slightly from side to side. Next the injection is made, rather slowly, after which the nozzle is quickly pulled out, and, as a matter of precaution against leakage, a finger is lightly pressed for a few seconds on the skin puncture. The only danger in the procedure is the possible pricking of a vein, thereby throwing the injection directly into the blood-current. But by observing the rules just given, the chances of this accident are very small indeed.

As regards the site of the injection, where, as is most commonly the case, the aim is simply to get the medicament into the general blood-supply, the site is indifferent and may be selected according to convenience. Situations are preferred

injection is meant to be, in part a local effect, then, of course, the is practised as near the affected Yet, under any circumstances, adherent portion of skin, like the avoided. The *dose* by the hypo should invariably be less, even to that which would be given by produce an equal effect.

CHAPTER II.

DOSAGE.

OUR last topic in general technology is *dosage*, meaning matters connected with the *determination* of doses of medicines. Here we have, first, to consider certain principles that apply generally, and, secondly, to note the circumstances under which ordinary doses must specially be modified. The general principles of dosage are best studied by examples. Let us first suppose a simple case : A woman is faint, and we medicate to whip up the faltering heart. A teaspoonful of brandy circulating in the blood will ordinarily do the business, and a teaspoonful of brandy is thereupon prescribed and taken, with, we will suppose, the expected effect. Here the matter has been simple ; the need for a medicinal influence was transient, and, there being no objection, the full quantity of drug required for the effect was given at once—here, that is, *dose* has been made to equal quantity necessary to be present within the system at a given time. But let us take another case : As a teaspoonful of brandy in the blood will oppose emotional heart-failure, so will twenty grains of *quinine* oppose an expected paroxysm of ague.

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dose will be likely to nauseate.
it, for the reason that this medic
stays in the blood several hours
of the disease-onset being know
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we do what the military com
must garrison with a strong for
proach is a weak bridge—we tak
the command across in small
break up, that is, our heavy cl
and give it, as the phrase is, in c
grains, say, every half-hour un
have been taken. The result
same as if the whole had been g
full garrison is present when th
and the assault is foiled. Next,
the conditions differ—conditio

ly, perhaps oftener than not, must persist in full force through quite a siege, while yet the molecules of the dose on duty are steadily deserting by excretion. *Reinforcement*, then, plainly presents now as a feature of dosage, and the practical question at once arises by which of two opposite methods shall such a reinforcement be carried out. Shall we, as it were, by frequent single recruiting, fill vacancies as fast as made, or shall we deliberately wait until the depletion be considerable, and then, at a stroke, restore to full quota? Evidently the latter method is the more convenient, but evidently yet it fails of the effect which the other secures of *maintaining the strength of the command steadily at a fixed figure*. And herein is the pith of the whole matter—a consideration which only rather recently has received the thought it deserves, namely, the importance of having the remedial impression, while it lasts, *equable*. The advantages of such equability are obvious, and often indeed the medication may wholly fail of its end unless this condition be fulfilled. Now, such fulfilment is only possible by *frequency of reinforcement*, and thus obtains the important rule that, in continuous medication, after the system is once properly charged with the drug, *renewals are to be on the plan of "little and often," rather than on that of large doses at long intervals*. But in obeying the

the rapidity of their elimination. Thus the heavy metals are, so to speak, upon the tissues; their effects are long, and their excretion slow. Such an influence, as constitutional mercurialism, must be maintained at an even pitch by frequent dosages, oftener than thrice, twice, or even once daily. On the other hand, the principles that swoop on the vital forces, such as ethers and many alkaloids, must be repeated, in dosage, with great frequency. The heart is to have its pulse-rate evened out, as with aconite, the renewals must be as frequent as possible, otherwise the pulse-rate will rise and fall in a regular wave between dosings. The point to be considered is that, in cases where the frequency of renewal is theoretically

that *extreme* scientific precision of medication is not worth the worry it entails.

We have thus elucidated the following as general principles of dosage in constitutional medication: *The basis of calculation is the percentage of drug to blood necessary for the effect*, a quantity which, under ordinary circumstances (exceptions anon), is for each drug a fairly fixed quantity. Then the dose, proper, follows thus: If the effect need be but transient, and if there be no objection, the whole amount necessary to establish the percentage is given at once, as in the case of the teaspoonful of brandy to revive from a faint; if, however, the need still being but a passing one, there be an objection to a large single dose, as in the quinine example, the quantum is given in fractional parts at proper intervals. If the influence must be at all prolonged, the requisite percentage is first established by either of the foregoing methods, and then maintained by reinforcements made, preferably, small and frequent, the dose at each renewal being, of course, duly proportioned to the frequency.

The next point in dosage is a simple and obvious one. One grain of quinine appetizes; twenty grains derange digestion but develop the new potency of reducing fever-heat. Both effects are utilizable therapeutically, but the dose for the *different purposes* differs enormously. With

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formulae, however, so far as they apply, we have several, of which two, because of their ease of application, are the favorites, wherein, for convenience' sake, the dose is related to the age, simply. Of course all children of the same age are not of the same bulk, but yet for purposes of a general formula it is accurate enough to assume them so, any considerable departure from average size in a particular case being easily allowed for after the average dose has been obtained. The formulae are as follows: *Young's* rule is, that, taking the adult dose at unity, the fraction thereof proper for a child of given age may be found by the formula:

$$\frac{\text{age}}{\text{age} + 12}$$

At age six, for instance, the fraction is $\frac{6}{6+12} = \frac{6}{18} = \frac{1}{3}$: *i.e.*, a child six years old takes one-third of the adult dose. *Cowling's* formula is, under the same premises:

$$\frac{\text{age at next birthday}}{24}$$

At present age six, that is, the formula gives the fraction $\frac{7}{24} = \frac{1}{3} -$: rather less than one-third. In general, with the younger ages, *Cowling's* formula yields a slightly smaller dosage than *Young's*; the one or the other may be used, therefore, according as we may wish scant or full dosing for the age.

But, apart from matter of size, there are many conditions—conditions of patient or of his en-

The more prominent of the conditions modifying the effects are as follows: First, *age*. As a rule, more susceptible to drug effects are the young adults, though with a few drugs the old people also, actively perturbed by disease, effects are badly borne. *Sex* gives women being more impressible than men. *Climate* has an influence, again, warm weather increasing, in general, disproportionate effects of violent or debilitating therapeutic measures. *Idiosyncrasy*, peculiar, undue susceptibility of the individual, predisposes to disturbing measures. *Continued taking*, with some drugs, some enfeebles the effects, with some increases the intensity of certain of the effects, with some has no influence. One of the most important instances of a modifying influence is that of the *habit* of taking drugs.

idiosyncrasy, like custom, may work either way, curious instances of exceptional susceptibility on the one hand, and of insusceptibility on the other, presenting themselves from time to time. With certain drugs individual idiosyncrasy as regards their influence is peculiarly common, necessitating exceptional caution in their prescription to stranger patients. Tobacco offers a well-known instance of this peculiarity, while, of drugs proper, opium, ipecac, and mercury afford marked examples.

Next, *special physiological status* of the system, generally, or of some part concerned, often affects, and most profoundly, the influence of a drug. Thus, locally, a dirty, thick, or inflamed skin will absorb less perfectly than a clean, a thin, or a healthy one; a full stomach will be affected less by a medicine than will an empty one, and, in narcotic poisoning or in collapse, even an empty stomach may refuse to absorb at all. On the other hand, if the local effect of a remedy be irritating, and if the surface receiving the application be already irritated or inflamed, the local influence will be more intense than ordinary. Constitutionally, too, morbid states may throw out of gear, and most strangely, the usual relation between dose and results. A striking example is in the case of narcotic drugs, which, by the very *circumstances calling for their prescription*, may

rhage a quart of brandy may be
revive the flickering heart, and the eff
no more than, in health, would foll
spoonful. In such cases, therefore,
must be set at naught and the rem
pushed until either the therapeusis so
tained or signs of beginning poison
discontinuance. This effect of morbid
idiosyncrasy of disease, as it might be
one constantly presenting itself, and
fore, that must ever be present in t
the prescriber.

Such, then, are, in outline, the co
affecting dosage, and, reviewing the
an important fact appears, from v
an equally important corollary: t
concerning a medicine, *dose is not a*

APPENDIX.

TABLE OF THE SOLUBILITY OF CHEMICALS IN WATER AND IN ALCOHOL.

[From the *U. S. Pharmacopœia* of 1880.]

Abbreviations: s. = soluble; ins. = insoluble; sp. = sparingly; v. = very; alm. = almost; dec. = decomposed.

CHEMICALS.	WATER.		ALCOHOL.	
	At 15° C. (59° F.).	Bolling.	At 15° C. (59° F.).	Bolling.
	Parts.	Parts.	Parts.	Parts.
<i>One part is soluble in :</i>				
Acidum Arseniosum ¹	30-80	15	sp.	sp.
" Benzoicum.....	500	15	8	1
" Boricum.....	25	3	15	5
" Carbolicum.....	20	—	v. s.	v. s.

¹ Acidum Arsenosum, *U. S. Ph.*, 1880.

THE SOLUBILITY OF CHEMICALS—Continued

CHEMICALS.	WATER.		ALCOHOL.
	At 15° C. (59° F.).	Boiling.	At 15° C. (59° F.).
	Parts. v. s.	Parts. v. s.	Parts. dec.
soluble in :			
.....	0.75	0.5	1
.....	100	3	4.5
.....	450	14	2.5
.....	6	v. s.	0.6
.....	0.7	0.5	2.5

Cerri Oxalis.....	ins.	ins.	ins.	ins.
Chloral	v. s.	v. s.	v. s.	v. s.
Chrysarobinum.....	alm. ins.	alm. ins.	sp.	sp.
Cinchonidinæ Sulphas.....	100	4	71	12
Cinchonina	alm. ins.	alm. ins.	110	28
Cinchoninæ Sulphas.....	70	14	6	1.5
Codeina.....	80	17	v. s.	v. s.
Creta Præparata.....	ins.	ins.	ins.	ins.
Cupri Acetas	15	5	185	14
“ Sulphas.....	2.6	0.5	ins.	ins.
Elaterinum.....	ins.	ins.	125	2
Ferri Chloridum.....	v. s.	v. s.	v. s.	v. s.
“ Citras	s.	v. s.	ins.	ins.
“ et Ammonii Citras.....	v. s.	v. s.	ins.	ins.
“ “ Sulphas.	3	0.8	ins.	ins.
“ “ Tartaras.....	v. s.	v. s.	ins.	ins.
“ Potassii Tartaras.....	v. s.	v. s.	ins.	ins.
“ Quininæ Citras.....	s.	v. s.	ins.	ins.
“ Strychninæ Citras.....	v. s.	v. s.	ins.	ins.
“ Hypophosphis.....	sp.	sp.	ins.	ins.
“ Lactas.....	40	12	alm. ins.	alm. ins.
“ Oxalas.....	sp.	sp.	ins.	ins.

THE SOLUBILITY OF CHEMICALS—Con

CHEMICALS.	WATER.		ALC.
	At 15° C. (59° F.).	Boiling.	
<i>s soluble in :</i>	<i>Parts.</i>	<i>Parts.</i>	<i>Parts.</i>
.....	0.4	v. s.	6.5
.....	ins.	ins.	ins.
onii Citras.....	v. s.	v. s.	sp.
onas.....	ins.	ins.	ins.
is.....	ins.	ins.	ins.
.....	33	—	dec.
.....	75	9.5	35
.....	0.7	v. s.	1
.....	ins.	ins.	ins.

Cerri Oxalis.....	ins.				ins.
Chloral.....	v. s.				v. s.
Chrysarobinum.....	alm. ins.				sp.
Cinchonidinæ Sulphas.....	100	4			12
Cinchonina.....	alm. ins.				28
Cinchoninæ Sulphas.....	70	14			1.5
Codeina.....	80	17			v. s.
Creta Preparata.....	ins.	ins.			ins.
Cupri Acetas.....	15	5			14
„ Sulphas.....	2.6	0.5			ins.
Elaterinum.....	ins.	ins.			2
Ferri Chloridum.....	v. s.				v. s.
„ Citras.....	s.				ins.
„ et Ammonii Citras.....	v. s.				ins.
„ „ Sulphas.....	3	0.8			ins.
„ „ Tartas.....	v. s.				ins.
„ Potassii Tartas.....	v. s.				ins.
„ Quininæ Citras.....	s.				ins.
„ Strychninæ Citras.....	v. s.				ins.
„ Hypophosphis.....	sp.	sp.			ins.
„ Lactas.....	40	12			alm. ins.
„ Oxalas.....	sp.	sp.			ins.

THE SOLUBILITY OF CHEMICALS—Con

CHEMICALS.	WATER		ALCOHOL
	At 15° C. (59° F.).	Boiling.	At 15° C. (59° F.).
<i>is soluble in :</i>	<i>Parts.</i>	<i>Parts.</i>	<i>Parts.</i>
hydratum	ins.	ins.	ins.
...	v. s.	v. s.	ins.
...	v. s.	v. s.	ins.
...	1.8	0.3	ins.
...	1.8	0.3	ins.
...	ins.	dec.	v. s.
...	16	2	3
...	ins.	ins.	ins.
...	12.8	3	15
...	alm.	ins. alm.	ins.
...			130

Hydrargyri Oxidum Flavum.....	ins.	ins.	ins.	ins.
“ “ Rubrum.....	ins.	ins.	ins.	ins.
“ “ Subsulphas Flavus.....	ins.	ins.	ins.	ins.
“ “ Sulphidum Rubrum.....	ins.	ins.	ins.	ins.
Hydrargyrum Ammoniatum.....	v. s.	v. s.	v. s.	v. s.
Hyoscyaninæ Sulphas.....	ins.	ins.	ins.	ins.
Iodoformum.....	sp.	—	—	15
Iodum.....	4	2.5	11	—
Lithii Benzoas.....	v. s.	v. s.	12	10
“ Bromidum.....	130	130	v. s.	v. s.
“ Carbonas.....	5.5	2.5	ins.	ins.
“ Citras.....	v. s.	v. s.	sp.	sp.
“ Salicylas.....	alm. ins.	alm. ins.	v. s.	v. s.
Magnesia.....	alm. ins.	alm. ins.	ins.	ins.
“ “ Ponderosa.....	alm. ins.	alm. ins.	ins.	ins.
Magnesium Carbonas.....	alm. ins.	alm. ins.	ins.	ins.
“ Sulphas.....	0.8	0.15	ins.	ins.
“ Sulphis.....	20	19	ins.	ins.
Mangani Oxidum Nigrum ¹	ins.	ins.	ins.	ins.
“ Sulphas.....	0.7	0.8	ins.	ins.
Morphina.....	v. sp.	500	100	36

¹ Mangani Dioxidum, *U. S. Ph.*, 1890.

THE SOLUBILITY OF CHEMICALS—Con

CHEMICALS.	WATER.		ALC.
	At 15° C. (59° F.).	Boiling.	
	Parts.	Parts.	
<i>is soluble in ;</i>			Parts.
.....	12	1.5	68
chloras	24	0.5	63
s.....	24	0.75	702
.....	ins.	ins.	v. sp.
alicylas	130	30	12
.....	150	25	10
ochloras	v. s.	v. s.	v. s.
.....	alm. ins.	alm. ins.	30
.....	1.8	0.5	8
.....	ins.	ins.	ins.

Potassa	0.5	v. s.	2	v. s.
Potassii Acetas.....	0.4	v. s.	2.5	v. s.
“ Bicarbonas	3.2	dec.	alm. ins.	alm. ins.
“ Bichromas	10	1.5	ins.	ins.
“ Bitartas.....	210	15	v. sp.	v. sp.
“ Bromidum	1.6	1	200	16
“ Carbonas.....	1	0.7	ins.	ins.
“ Chloras	16.5	2	v. sp.	v. sp.
“ Citras.....	0.6	v. s.	v. sp.	v. sp.
“ Cyanidum	2	1	sp.	sp.
“ et Sodii Tartas	2.5	v. s.	alm. ins.	alm. ins.
“ Ferrocyanidum.....	4	2	ins.	ins.
“ Hypophosphis.....	0.6	0.3	7.3	3.6
“ Iodidum.....	0.8	0.5	18	6
“ Nitras.....	4	0.4	alm. ins.	alm. ins.
“ Permanganas	20	3	dec.	dec.
“ Sulphas	9	4	ins.	ins.
“ Sulphis.....	4	5	sp.	sp.
“ Tartas.....	0.7	0.5	alm. ins.	alm. ins.
Quinidinæ Sulphas.....	100	7	8	v. s.
Quinina.....	1600	700	6	2
Quininæ Bisulphas	10	v. s.	32	v. s.

THE SOLUBILITY OF CHEMICALS—Con

CHEMICALS.	WATER.		ALCOHOL.
	At 15° C. (59° F.).	Boiling.	At 15° C. (59° F.).
<i>is soluble in;</i>	<i>Parts.</i>	<i>Parts.</i>	<i>Parts.</i>
Ammonia.....	16	1	3
Ammonia chloras.....	34	1	3
Ammonia.....	740	30	65
Ammonia.....	100	40	5
Ammonia.....	0.5	0.2	175
Ammonia.....	7	1	ins.
Ammonia.....	28	0.7	30
Ammonia.....	alm. ins.	250	40
Ammonia.....	1.7	0.8	v. s.
Ammonia.....	3	1	30

Sodii Bicarbonas Venalis.....	12	dec.	ins.	ins.
" Bisulphis.....	4	2	72	49
" Boras.....	16	0.5	ins.	ins.
" Bromidum.....	1.2	0.5	13	11
" Carbonas.....	1.6	0.25	ins.	ins.
" Chloras.....	1.1	0.5	40	43
" Chloridum.....	2.8	2.5	alm. ins.	alm. ins.
" Hypophosphis.....	1	0.12	30	1
" Hyposulphis.....	1.5	0.5	ins.	ins.
" Iodidum.....	0.6	0.3	1.8	1.4
" Nitras.....	1.3	0.6	sp.	40
" Phosphas.....	6	2	ins.	ins.
" Pyrophosphas.....	12	1.1	ins.	ins.
" Salicylas.....	1.5	v. s.	6	v. s.
" Santoninas.....	3	0.5	12	3.4
" Sulphas.....	2.8	0.4	ins.	ins.
" Sulphis.....	4	0.9	sp.	sp.
" Sulphocarbolas.....	5	0.7	132	10
Strychnina.....	6700	2500	110	12
Strychninæ Sulphas.....	10	2	60	2
Sulphur Lotum.....	ins.	ins.	ins.	ins.
" Precipitatum.....	ins.	ins.	ins.	ins.

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